Ohio’s 5G and Broadband Workforce

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Advancements in fifth generation (5G) technology and broadband communications create novel opportunities in numerous sectors, especially with regard to workforce development. As modern society further shifts to become that of an ‘information society’, 5G and broadband investment, development, and use have been shown to increase income, employment, and business expansion, especially in rural areas.

Keywords: 5G and broadband ; skillshed ; Ohio ; career transitions

1. Introduction

Advancements in fifth generation (5G) technology and broadband communications create novel opportunities in numerous sectors, especially with regard to workforce development. As modern society further shifts to become that of an ‘information society’, 5G and broadband investment, development, and use have been shown to increase income, employment, and business expansion, especially in rural areas [1][2][3][4]. It is important to note that the findings of these studies exist across multiple time periods; Whitacre et al. (2014) showed that increased broadband adoption increased median household income and business activity from 2008–2011 [1], while Isley and Low (2022) and Rupasingha et al. (2023) found that broadband adoption increased employment growth and employment rates in rural areas, both prior to and during the COVID-19 pandemic [2][3]. These results suggest that developments in rural broadband can be an important tool in fighting socioeconomic disadvantages that are all too common in rural communities.

Implementing 5G and broadband technology will increase the demand for labor to do so, thereby creating jobs and requiring workforce development. Significant resources have already been devoted to enhancing the rollout of broadband in the US. Roughly two-thirds of the Infrastructure Investment and Jobs Act’s 64.4 billion dollars has been earmarked for the Broadband Equity, Access, and Development (BEAD) program [5][6]. Broadband services, which are typically divided into either fixed or mobile broadband, require a variety of skillsets to function properly. Some of the workers that are employed in broadband include construction workers, technicians, and network engineers and architects, in addition to those who service cell towers, which are only used in mobile broadband. As of January 2022, fixed and mobile broadband services employ over 550,000 workers in the US [6]. While unemployment rates among jobs related to broadband deployment suggest a labor shortage, other measures, such as employment and wage growth, do not. Findings by Congressional Research Services (2022) and the US Government Accountability Office (2022) are especially pertinent to rural areas, given that broadband workers tend to be sparse in these areas [5][6]. In addition, broadband workers cannot easily be brought into the rural communities. This fact corroborates the importance of training current residents. There has been an ongoing effort to increase opportunities and residents’ knowledge in this area, in addition to training for 5G and broadband-related careers, as both apprenticeships and on-the-job training exist for such occupations.

2. Fifth Generation and Broadband

Discussions surrounding 5G technology have intensified in recent years as industrial shifts and changing consumer demand for technology have developed a need for more advanced telecommunications networks. While 5G builds on existing telecommunications networks, experts note that 5G technology has the potential to revolutionize the world by integrating multiple aspects of technology within everyday societal and economic functions [7]. Since first generation (1G) technology was introduced in the late 1970s [8][9], new generations have primarily focused on advancements in communication, such as transitioning from analog to digital technology and improving voice quality for calls. However, 5G marks a departure from these advancements in that it lays the groundwork for broader changes in how technology can be used.

Fifth generation makes use of advanced technology, both wired and wireless, to connect a variety of heterogeneous devices across networks made up of multiple layers [9][10]. This technology includes new radio (NR), multiple input multiple output (MIMO) antennas, and more [8]. Dangi et al. (2021) and Sohaib et al. (2023) note three key services brought about

by 5G technology: (a) extreme mobile broadband (eMBB), (b) massive machine type communication (mMTC), and (c) ultra-reliable low-latency communication (URLLC). eMBB is primarily responsible for providing consumers with lightning-fast internet connections, allowing them to stream ultra-high-definition (UHD) videos and make use of augmented or virtual reality technologies [7][9][11]. For eMBB to effectively work, it must function in a variety of environments, including indoor settings, urban cores, and sparsely populated rural regions. mMTC primarily supports the internet of things (IoT) and encompasses the wide range of devices that must connect with one another in order for 5G technology to function effectively [12]. mMTC makes use of devices, such as sensors, that require a low volume of data to monitor processes that are not typically time sensitive. This allows for these processes to be completed in a cost-effective manner with low power consumption. Finally, URLLC involves processes in which instantaneous, low-latency communication is critical. Unlike mMTC, functions making use of URLLC are extremely time-sensitive. These include cases such as remote surgery procedures, vehicle to vehicle communication, and other industrial processes [13].

For the everyday consumer, advancements in broadband are perhaps the most significant changes brought about by 5G technology as telecommunications systems place a bigger emphasis on user experiences [14]. eMBB will allow for the high quality of service (QoS) and the large number of device connections that are necessary for 5G technology to function properly without using too much power, while also supporting broadcasts, such as mobile TV and live content, in addition to its support of the broadcast industry as a whole [15][16]. To fulfill the needs of eMBB, several solutions have been proposed. Some suggest the use of device-to-device (D2D) connections in order to reduce internet traffic volumes traveling through base stations. Others have noted the need for scheduling algorithms and technology beyond fiber-optic communication, such as millimeter wave wireless communication, which would allow for a wide range of coverage at a rapid pace [17][18]. Regardless of which solution or combination of solutions is used, significant upgrades in technology will be required to enhance existing mobile broadband networks.

3. Opportunities Related to 5G and Broadband

In addition to the enhancements in latency, data transmission, and video streaming that were mentioned previously, Liu et al. (2021) note that 5G will lead to changes in how robots can be used. Not only will these changes drive the use of robots in autonomous driving and remote surgery, but they will also allow them to better solve spatial problems, reducing costs associated with overcoming environmental barriers to robotic functions [19]. Furthermore, 5G will allow for improved delivery and transportation of goods, as well as enhancements in customer service brought about by developments in various industries that will ultimately contribute to a better quality of life for consumers. These developments include better healthcare, increased inclusion of those with disabilities, and enhanced interconnectedness between people, including between those impacted by the rural–urban divide [20]. Finally, 5G and broadband innovations provide opportunities for better food production, smart cities, and the integration of more sustainable technology within society [21][22]. In light of these opportunities, Wright (2023) notes that, due to the growing reliance on technology in institutions like education, everyone must have an equal opportunity to take advantage of such enhancements in broadband so that existing inequalities are not further exacerbated [23].

4. Fifth Generation and Broadband in Ohio

Between 2001 and 2021, there has been a significant decline in employment in the telecommunications sector, which includes 5G and broadband, both nationally and in Ohio [24]. However, the number of proprietors in the telecommunications industry has remained relatively stable. In 2021, just under 20,000 workers were employed in the telecommunications industry in Ohio, down from over 40,000 in 2001, while the number of proprietors has remained at roughly 4500. In light of anticipated investments in the sector, telecommunications employment is expected to increase. Workers hired by the telecommunications industry primarily consist of those responsible for installing equipment, many of whom have skills specific to the telecommunications industry, such as ‘Telecommunications Equipment Installers and Repairers, Except Line Installers’ and ‘Telecommunications Line Installers and Repairers’, both of which are among the most frequently employed occupations within the telecommunications industry. Some of the skills required by ‘Telecommunications Equipment Installers and Repairers, Except Line Installers’ include ‘Repairing’ and ‘Troubleshooting’, while ‘Telecommunications Line Installers and Repairers’ need to be skilled in ‘Complex Problem Solving’ and ‘Operations Monitoring’ [25][26]. Both occupations also require workers to be skilled in ‘Critical Thinking’, and they typically require workers to have at least a ‘high school diploma or equivalent’.

In recent years, the state of Ohio has invested significant resources into the expansion of broadband and 5G technology. Governor Mike DeWine’s office estimates that over 300,000 households, comprising almost 1,000,000 Ohioans, lack sufficient broadband access [27]. In response to these challenges, the state launched the Ohio Broadband Strategy in 2019, which seeks to assist those who are unserved or underserved by the state’s existing broadband networks in

accessing them. The state has also developed the BroadbandOhio Office, which, in addition to the resources provided by House Bill 2, will work to connect communities that lack broadband access. The office has also been tasked with community engagement and project management initiatives in order to expand access to online health and education resources in order to better connect residents with the modern-day economy.

The state has spearheaded various regional programs, in addition to programs developing Ohio's 5G and broadband workforce. These include Regional Digital Inclusion Alliances (RDIAs) across the state, which are supported by BroadbandOhio and the State Digital Equity Planning Grant Program [28]. RDIAs work to create cohesive regional plans and inclusion efforts for historically underserved populations. This program will work alongside other programs related to broadband equity and inclusion, such as the Ohio Residential Broadband Expansion Grant program, which was created using the state's $793 million in federal BEAD funding [29]. These programs will also work with community initiatives, such as the East Cleveland Connectivity Project, the Muskingum Valley Educational Service Center Telehealth Project, and the Riverside Connectivity Pilot [30][31][32]. Additionally, various programs meant to support employment in the 5G and broadband industry have been launched throughout the state, focused on providing residents with resources and opportunities focused on curriculum expansion, internship opportunities, and workforce training [33]. Engineering education programs can be difficult to develop due to the rapid pace at which technology changes. Therefore, such programs must ensure that students are able to adapt to new technological advancements post-graduation [34]. In spite of this, Ohio has invested significantly in programs, including the Telecommunications Industry Registered Apprenticeship Program (TIRAP), administered by the Wireless Infrastructure Association (WIA), which trains workers in 5G and broadband occupations; the TechCred program, which assists Ohio employers in funding workforce training for technology related occupations; and the Individual Microcredential Assistance Program (IMAP), which helps disadvantaged Ohioans to access occupational training resources free of cost. Effective utilization of educational investments such as these, in addition to investments in workforce training, can be an effective way to capitalize on existing investments in broadband and 5G technology while creating many job opportunities for Ohioans [33].

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