

Internet Access and Native American Economic Development

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Abstract

This paper examines the relationship between internet access and Native American economic development. First, it synthesizes various insights from institutional economics and market-process economics to examine how expanded internet access can improve development on reservations. Reliable, high-speed internet access facilitates a greater degree of specialization and exchange, contributing to economic growth for Native American communities. Internet access directly contributes to development because it provides more ways for private entrepreneurs and tribally owned enterprises to reach consumers, as well as outside firms to exchange with reservation residents. Reliable, high-speed internet access indirectly aids economic development by improving human capital through better access to education and telemedicine. Technological innovations and institutional reforms can reduce the costs of providing internet. Second, this paper describes the real-world institutional and economic barriers that limit internet access on reservations. Third, this paper uses a case study of the Colville Indian Reservation to examine how a real-world technological innovation has improved internet access, thus expanding the extent of the market and facilitating development. The case study is instructive because it examines how recent technological innovations on the Colville Indian Reservation have augmented opportunities in business, health, and education.

Keywords: economic development, Native American, internet, telecommunications, innovation, entrepreneurship, institutions, market access

JEL Codes: O12; O18; O31

I. Introduction

Across the United States, Native Americans face disproportionately high rates of poverty and have relatively low household incomes. Roughly one-quarter of the total Native American population lives below the federal poverty line, and some reservations have much higher poverty rates (Kaiser Family Foundation 2022). As of 2022, the median household income in the United States was \$75,149, which is significantly higher than the three most populous reservations: the Navajo Nation at \$32,579; the Pine Ridge Reservation at \$34,567; and the Fort Apache Reservation at \$39,735.¹

Scholars in political economy generally agree that formal and informal institutions impose high transaction costs on reservations' economic activity, exacerbating poverty. For instance, the federal land-trust system is meant to protect lands and resources on reservations, but the system also raises the costs of using those lands and resources in terms of both time and money. Additionally, various forms of bureaucratic red tape—as well as legal uncertainty regarding taxation schemes, judicial jurisdiction, and access to capital markets, among other issues—create barriers to potential entrepreneurs and limit opportunities for economic growth (Akee and Jorgensen 2014; Anderson et al. 2024; Anderson and Parker 2008, 2009, 2024; Cornell and Kalt 1995; Lofthouse 2019a, 2019b; McChesney 1990; Miller 2024; Piano and Rouanet 2024; Provins 2024; Regan and Anderson 2014).

The institutional barriers mentioned above certainly contribute to the slow rates of Native American economic development, but one of the largest barriers is isolation—both physical and digital. A majority of Native Americans live in rural areas, usually on or near reservations, which have limited access to reliable, high-speed internet. Estimates place the proportion of Native Americans who live in rural areas slightly above 50 percent, depending on how *rural* is defined (Deweese and Marks 2017). In 2018, the Federal Communications Commission found that 30.7 percent of Americans in rural areas and 35.4 percent of Americans on tribal lands lacked access to broadband internet. By 2021,

¹ For more information on median household income across the United States and the reservations mentioned above, see (1) US Census Bureau, American Community Survey and Puerto Rico Community Survey, 5-Year Estimates, “Median household income (in 2021 dollars), 2017–2021”; (2) US Census Bureau, 2017–2021 American Community Survey 5-Year Estimates, “Navajo Nation Reservation and Off-Reservation Trust Land, AZ—NM—UT”; (3) US Census Bureau, 2017–2021 American Community Survey 5-Year Estimates, “Pine Ridge Reservation, SD—NE”; (4) US Census Bureau, 2017–2021 American Community Survey 5-Year Estimates, “Fort Apache Reservation, AZ.”

29 percent of Native households on tribal land lacked broadband access; however, access varies widely among reservations (Mejia 2024). For instance, in 2021 the Navajo Nation had a broadband subscription rate of only 33 percent (Mejia 2024). Although the difference in rates of internet access between reservations and other rural communities is relatively small, Native Americans living on reservations are on average substantially poorer than other rural communities (see Davis et al. 2023; Creamer et al. 2022).

In this paper, we examine the general causes of limited internet access on reservations and the consequences of expanding internet access for Native American economic development. First, we explore how an expansion of internet access can facilitate a greater degree of specialization, entrepreneurship, and exchange, contributing to economic growth. In many cases, a combination of technological innovations and policy reforms is necessary to expand internet access on reservations. Second, we discuss the real-world institutional and economic barriers that limit internet access on reservations. Third, we use Washington's Colville Reservation as an illustrative case study of the barriers to internet access and how technological innovations can expand access, leading to more opportunities for growth.

This paper fills two gaps in the literature on Native American development. First, it makes a theoretical contribution by synthesizing various insights from institutional economics and market-process economics as they relate to internet access. Although many scholars have written on the internet as a tool for development, few have tied those ideas specifically to the Native American context, leaving room for a deeper discussion (see Blackwater 2020; Yoo et al. 2021; Korostelina and Barrett 2023). Second, our case study of Washington's Colville Indian Reservation demonstrates how technological innovations and public policy reforms can improve internet access, leading to greater opportunities for economic development. Our case study documents the personal experiences of James Ronyak, who served as the chief information officer of the Colville Reservation from 2012 to 2014. Ronyak helped to create an innovative way to expand internet access to this rural, isolated community.

Our theoretical argument is that sustainable economic development—for Native Americans or anyone else—results from the combination of entrepreneurship, socially productive institutions, and relatively broad access to markets, which allows individuals to divide their labor more fully, engage in more specialization, and take part in mutually beneficial exchange at a large scale (Acemoglu et al. 2005;

Baumol 1990; Becker and Murphy 1992; Boettke et al. 2008; Boettke and Coyne 2003; Holcombe 1998; Kirzner 1973, 1985; Schumpeter 2008; Smith 1982). Thus, reliable, high-speed internet access is and will continue to be a key component of Native American economic development because it expands the extent of the market on reservations.

Access to high-speed internet can facilitate Native American economic development directly and indirectly. On the direct side, on-reservation businesses—whether privately or tribally owned—have greater access to outside markets through the internet. Additionally, off-reservation businesses can better access willing consumers and potential employees on and near reservations. On the indirect side, internet access can improve human capital through education and telemedicine, supplementing economic development. A lack of reliable high-speed internet limits how entrepreneurs can reach new customers, how individuals can access information, how schools can teach classes, and how doctors can visit with patients.

Technological and public policy barriers are two main contributors to a lack of internet access on Native American lands. In many cases, laying traditional fiber optic cables to these remote places is prohibitively costly. Additionally, the complex and convoluted governance institutions on reservations—including laws and regulations at the national, state, county, and tribal levels—raise the transaction costs of providing reliable high-speed internet. Thus, innovations in both technology and public policy are necessary to bring internet access to underserved Native American communities. This paper examines broad commonalities across Indian Country; however, each reservation exists within a distinct context. Any application of the insights presented here to a specific reservation should carefully account for context-specific factors and make relevant caveats.

This case study of the Colville Reservation documents how tribal leaders, especially Ronyak, implemented successful technological innovations and policy reforms. The evidence for this case study comes from personal interviews with Ronyak about his experience in tribal leadership. Starting in 2012, leaders on the Colville Reservation, federal officials, and private telecommunication companies began building infrastructure to give reservation residents access to high-speed wireless internet. These individuals developed an innovative system of solar- and wind-powered mountaintop cell towers that wirelessly transmit the internet to these communities. These towers became a viable solution either because other forms were prohibitively

costly or because other public policies were in the way. In the few years since internet access was expanded on the Colville Reservation, private and tribal businesses have had greater reach, educational opportunities have been more plentiful, and telehealth is now viable. By documenting real-world experiences of navigating governance institutions, this case study is intended to illuminate the institutional barriers that Native Americans face. It is also intended to demonstrate how real-world technological innovations can and do expand internet access, thus facilitating development.

This paper proceeds as follows. In section 2, we review the theoretical foundations of economic development with special attention to the role of institutions, the processes of entrepreneurship, and access to markets. We then analyze the relationship between economic development and the internet. In section 3, we tie the theoretical insights from section 2 to the context of Native American reservations in the United States. In section 4, we discuss the real-world institutions that govern Native American reservations and how those institutions and other economic barriers hinder the expansion of internet access on reservations. In section 5, we describe the personal experiences of leaders on the Colville Reservation as a case study to examine how innovation in technology and reforms to public policies can better provide internet on reservations. Section 6 concludes with the implications of this research.

II. The Process of Economic Development and the Effects of the Internet

The scholarship on economic development broadly agrees that achieving the highest standards of living requires at least two factors. First, formal and informal institutions must channel entrepreneurship in socially productive ways. Second, individuals must have access to globalized, interconnected markets that allow for high degrees of specialization and trade.

Entrepreneurship has been defined in many ways, but we focus on two ways here: innovation and arbitrage. In the conception of entrepreneurship-as-innovation, the entrepreneur discovers and implements new ways of directing the means of production to more highly valued uses that better fulfill human desires (Schumpeter 1983, 2008). In the conception of entrepreneurship-as-arbitrage, entrepreneurs are alert to and discover opportunities to buy a good at a low price and sell it somewhere else at a higher price. Entrepreneurs recognize profit opportunities that arise because of changes or errors

in the market (Kirzner 1973, 1985). In these complementary views, entrepreneurs are agents of change that drive economic development.

Entrepreneurs are embedded in institutional contexts that shape what they are alert to and what decisions they make. Institutions are formal and informal rules that shape the incentives and constraints that individuals face, as well as determining how individuals interact with one another (North 1990; Ostrom 2005). Different institutional arrangements guide entrepreneurs to act in either socially productive or destructive ways. For institutions to promote economic development, they must facilitate mutually beneficial exchange and innovation. To do this, institutions must define and enforce property rights and contracts, as well as removing uncertainty and making the actions of other individuals predictable. Institutional arrangements that do not promote economic development incentivize predation, foster unpredictability, distort market prices, lead individuals to behave in socially wasteful ways, create credible-commitment problems, and allow political actors to arbitrarily interfere in economic affairs (see Baumol 1990; North 1990; Murphy, Schleifer, and Vishny 1991; 1993; Acemoglu, Johnson, and Robinson 2001; 2002; 2005; Acemoglu and Johnson 2005; Boettke, Coyne, and Leeson 2008; Sobel 2008).

Institutions that channel entrepreneurship in socially productive ways are necessary but not sufficient for economic growth. One of Adam Smith's ([1776] 1982, 1:31) core insights is that if the extent of any market is limited, the division of labor and specialization will also be limited, constraining the ability of individuals and societies to reach modern levels of prosperity. When larger numbers of people are interconnected, they can divide their labor in more ways and become highly specialized, leading to more production of increasingly technical goods and services. However, when people are not well connected or in proximity to one another, they cannot divide their labor and specialize as easily, thus limiting their ability to engage in mutually beneficial exchange. In other words, a small, isolated group, even with the best of institutions, could not produce the complex goods and services that are needed for today's standards of living. Modern medicine, electronics, clothing, and abundant food, among many other goods and services, require an interconnected, globalized economy.

The internet can expand the extent of the market, thus increasing the opportunities for economic growth. The literature has generally found a positive relationship between internet access and economic development, but how successfully internet access spurs economic

growth is dependent on many factors, such as governance institutions, infrastructure, and culture. Internet access can facilitate communication, assist the transmission of information, improve labor productivity, reduce costs, promote resilience to external shocks, and create other desirable byproducts like consumer surplus, innovation, and the opening of new markets. However, internet access can be associated with undesirable effects, such as increased inequality on some margins. Additionally, in some cases, increases in GDP per capita may lead to increased internet use, rather than internet use leading to increases in GDP per capita (see Madon 2000; Clarke and Wallsten 2006; Qiang et al. 2012; Friederici, Ojanperä, and Graham 2017; Sekmen and Gokirmak 2018; Bilan et al. 2019; Blackwater 2020; Barrero, Bloom, and Davis 2021; Mora-Rivera and García-Mora 2021; Haghsheenas, Kasimin, and Berma 2013; Pradhan, Arvin, and Norman 2015; Yousefi 2015; Wannapan and Chaiboonsri 2018).

Despite a broad consensus that internet access can and does contribute to economic development in both wealthier and poorer countries, some trade-offs and shortcomings are undeniable. Cyber risks, such as data fraud, data theft, cyberattacks, and critical information infrastructure breakdown, have emerged as new threats to growing economies (Bilan et al. 2019). Overall, the internet is not a panacea for economic growth but is *a potential tool to facilitate growth*. For example, Friederici, Ojanperä, and Graham (2017) are skeptical of the seemingly “self-evident” propensity of the internet to contribute to development. Their review of the existing evidence concludes that internet access can improve economic growth, but only when a society has reached a “threshold level of existing users and infrastructure.” Thus, they warn against overstating the role of internet access in economic development without proper contextualization.

III. Internet Access as a Mechanism for Native American Economic Development

Although a literature on internet-related economic development has emerged over the past several years, few scholars have written on Native American development in particular. For instance, Blackwater (2020, p. 94) has argued that reliable high-speed internet access is “critical for economic development, educational and job opportunities, and public health and safety” for Native Americans. Expanding internet access to reservations and their surrounding areas will “improve the productivity, efficiency, and communication of businesses already located on tribal lands, and helps tribal communities attract new outside businesses that

may be looking to expand into tribal areas. Broadband access and sovereignty over spectrum can help to create millions (or billions) of dollars in revenue that can be reinvested into local economies” (p. 99). Additionally, Korostelina and Barrett (2023) have found multiple external and internal roadblocks to expanded broadband access for Native Americans, including lack of trust in the government, complicated processes, underestimation of the scope of various problems, financial burdens on tribes, limited resources, and challenging geography. Relatedly, Yoo et al. (2021) have found that when internet access has been expanded in Native communities, high school graduation rates have improved. Thus, internet access is one important tool, among many, to aid tribal governments and individual Native Americans in their economic ventures, but expanding internet access in these rural areas is a complex process.

Building on these arguments, we argue that sustainable long-term economic development on tribal lands is unlikely to succeed without a reliable connection to high-speed internet, which will only come about with technological innovations and public policy reforms. One alternative, however, is that many Native Americans could move from isolated, rural areas to urban areas where opportunities are more plentiful and the market is much larger. Despite the opportunities in urban areas, many Native Americans might not want to move far from their reservations for historical, cultural, familial, and identity reasons (see Gooding 1994; Jacobs 2015; Sokolove et al. 2002). Accordingly, the internet provides a way for Native Americans, or other people in rural areas, to have access to broader markets while also remaining physically located near their family, friends, and culture.

Internet access can contribute directly and indirectly to Native American economic development. Greater internet access expands *direct* opportunities for economic development through (1) individual entrepreneurs starting/expanding businesses, (2) tribal governments starting/expanding tribal enterprises, and (3) outside firms interacting with reservation residents. In terms of individual entrepreneurs, the internet has provided many opportunities for Native Americans to start their own businesses, and there have been successes on online platforms, such as Etsy. Internet-based Native entrepreneurs across the United States are currently running businesses that sell beadwork, jewelry, crafts, clothing, hats, cosmetics, food, travel cases, rugs, and spiritual items, among other goods (Edwards 2022; Ramhold 2021; Wilkerson 2020). These private businesses are often small, but they

provide a supplementary source of income for individuals who live in isolated areas with few employment opportunities.

Despite the important role of individual entrepreneurs, businesses owned by tribal governments are often more important for economic growth on reservations. Tribal businesses are often the major source of employment and the major source of revenue for the tribal government. Casinos are the most well-known tribal businesses, but tribes also run enterprises in a variety of sectors, such as tourism, energy, agriculture, forestry, manufacturing, and telecommunications (Atkinson and Nilles 2008). Of course, people can participate remotely in few of these industries, which points to smaller benefits from internet access, *ceteris paribus*. However, internet access also gives more opportunities for business diversity, which is a way to help tribal governments avoid putting all their proverbial eggs in one basket, such as tribal casinos. For example, after focusing solely on casinos, the Otoe-Missouria Tribe has broadened its tribal business to include financial technology, largely because of expanded internet access (Caliber Financial Services 2024). Although internet access has the potential to improve the revenue-generating potential of tribal enterprises, tribal institutions must carefully separate politics and business decisions; otherwise, the benefits of internet access are likely to be eroded (Lofthouse 2019a, 2019b).

Additionally, internet access facilitates connections between off-reservation businesses and individuals who live on or near reservations. These connections allow individuals to become potential customers and potential employees of these off-reservation businesses. These increased opportunities for both consumption and production contribute to the processes of economic development. However, in terms of employment, Native Americans consistently have fewer opportunities for remote work compared to white or Black Americans because of a lack of internet access, a higher incidence of frontline occupations that cannot be engaged in remotely, and lower rates of college education, which is correlated with work that is remote capable (Gregg and Maxim 2022).

Internet access also provides *indirect* development opportunities by fostering human capital accumulation through education and health care. Education has long been correlated with higher rates of economic growth. Generally, more educated individuals are more economically productive, have the skills to be innovative, and have a broader range of alertness to potential profit opportunities. However, greater education does not guarantee economic growth because education is heterogeneous, and

other institutional factors can mitigate the effects of education (Benhabib and Spiegel 1994; Hanushek and Woessmann 2021, 2015; Pereira and St. Aubyn 2009; Petrakis and Stamatakis 2002; Zhu and Li 2017). On reservations, internet access can benefit tribal communities by supplementing the education offered there. Additionally, internet access allows high school graduates to go to college online, without needing to leave the reservation. High school students have broader access to accelerated classes, advanced placement classes, or dual-enrollment classes that would otherwise be unavailable to them.

Additionally, the internet provides new means of accessing health care, such as telehealth, which can indirectly contribute to economic growth. Individuals who struggle with health problems are less productive and have fewer opportunities to build human capital or engage in entrepreneurship, thus limiting the possibility of economic growth. When economic growth is limited, people have fewer resources for health-promoting lifestyles and less access to quality health care (Bhargava et al. 2001; Lange and Vollmer 2017; Weil 2007; Yang 2020). When individuals who live in rural areas, like reservations, need medical attention, it may be difficult or costly to get to a hospital or Indian Health Service facility because of age, lack of transportation, long travel distances, and difficult driving conditions, among other reasons. With expanded internet access, tribal members can use telehealth at home or drive to a nearby community center to speak to a medical care provider through a telehealth connection.

IV. Real-World Barriers to Internet Access on and near Reservations

Despite the seemingly self-evident benefits of internet access on reservations, providing reliable high-speed internet access to many reservations is prohibitively costly. Reservation residents must go without internet access, use prohibitively slow internet, or purchase expensive satellite-based internet connections. Many rural areas do not have the physical infrastructure necessary for modern high-speed broadband, leaving internet access limited to slow-speed telephone lines at the T1 level (that is, 1.5 Mbps/1.5 Mbps). The slowness of the connection is a major barrier to effectively running online businesses, education, telehealth, and government functions. While satellite internet is viable for most places, it does suffer from limitations, such as line-of-sight problems (that is, objects obstruct the transmission of a signal) and rain fade (that is, rain deteriorates a signal).

In 2021, broadband access reached 90 percent of the entire US population, yet only 84 percent of American Indian and Alaska Native households had access. For those living on tribal lands, the figure dropped further to 71 percent (Mejia 2024). However, Indian Country has a wide range in terms of rates of access to broadband internet. In 2021, tribal residents in six states—Delaware, Florida, Georgia, Hawaii, Washington, and Wisconsin—reported broadband access rates at or above the national average of 90 percent. Conversely, tribal communities in three states—Arizona, Connecticut, and New Mexico—experienced some of the country’s lowest access rates, with Arizona and New Mexico falling below 70 percent (Mejia 2024). Table 1 shows the percentage of households with a broadband internet subscription on several reservations around the country.

Table 1. Percent of households with a broadband internet subscription on select reservations

Reservation name	Location	Population in 2022	Percent of households with a broadband internet subscription
Colville Reservation	Washington	7,073	74.5%
Fort Apache Reservation	Arizona	14,620	43.6%
Hopi Reservation	Arizona	7,895	37.4%
Navajo Nation Reservation	Arizona, New Mexico, and Utah	166,545	37.9%
Pine Ridge Reservation	South Dakota	18,961	59.3%
Standing Rock Reservation	North Dakota and South Dakota	7,817	74.7%
Ute Mountain Reservation	Colorado, New Mexico, and Utah	1,751	47.3%
Wind River Reservation	Wyoming	26,130	83.2%
Zuni Reservation	Arizona and New Mexico	8,134	46.5%

Source: Table made by authors; data come from 2018–2022 American Community Survey 5-Year Estimates of the United States Census Bureau, as found in “My Tribal Area” index.

There are two general categories of barriers that restrict reliable high-speed internet on most reservations: economic and institutional. In terms of economic barriers, private telecommunications companies, utility services, and various levels of government face a variety of costs. Individuals who live in urban areas where internet infrastructure already exists can simply place a phone call to an internet service provider, who will connect a residence to that infrastructure. If the infrastructure does not exist or if it is outdated, telecommunication firms or utility services might not find it profitable to invest in installing or upgrading internet infrastructure. The reasons for utility cost escalation can vary, but in rural areas, many of the costs are related to a lack of preexisting rights-of-way and a lack of preexisting infrastructure. The costs of installing infrastructure are highly context dependent and involve many factors: labor costs, installation method, regulatory compliance, geographical constraints (for example, spread-out populations, rocky terrain, mountains, or long distances), right-of-way costs, and more. Additionally, telecommunications firms and utility services might not see a viable way to recoup the upfront costs of new infrastructure in many rural areas because the limited number of potential customers do not offset those costs (Canfield et al. 2019; Dawson 2021; Graves et al. 2021; Korostelina and Barrett 2023).

When private companies or utility services cannot profitably extend internet infrastructure into rural areas like reservations, there may be a justification for the government to subsidize such infrastructure. However, both the federal government and tribal governments have limited resources to do so. The federal government recently created the Tribal Broadband Connectivity Program under the Coronavirus Response and Relief Supplemental Appropriations Act of 2021, which set aside nearly one billion dollars for Tribal Broadband Connectivity Grants. These grants are intended to facilitate access to broadband service on tribal lands (Bureau of Indian Affairs 2025). By 2022, the Biden administration awarded tens of millions of dollars to dozens of tribes across the country under the program (National Telecommunications and Information Administration 2022). The US Department of Agriculture's Community Connection Grant is another source of funding for utility construction (USDA Rural Development 2025).

Additionally, tribal governments could, in theory, subsidize access to the internet with their own money, but with a limited tax base and few options for revenue, many tribes do not have the resources to run

fiber or construct other types of infrastructure projects (Korostelina and Barrett 2023). Anecdotal evidence suggests that, in some cases, the financing is taken from other social programs to build out needed infrastructure. In many tribes, the economic development arm does not prioritize telecommunication infrastructure development and tends to focus on more “traditional” revenue-generating opportunities, such as gaming.

Thus, many tribes are dependent on federal grants if they want to subsidize internet access. However, grant application processes are often labyrinthine, and many tribes might not have qualified employees to successfully apply for, receive, and use such grants. Receiving grant money requires grant writers, grant reviewers, and dedication to the process of providing all the requirements of the awarding agency, which are often in short supply on reservations. Typically, grants are funded through the tribal community first and reimbursed by the federal agency when the requirements for reimbursement are met. If the requirements are not met by the tribal community, the federal agency can choose not to reimburse the costs, leaving the tribe responsible.

In addition to economic barriers, institutions can also impose barriers to internet access, such as regulatory permitting processes that involve multiple regulatory agencies at the tribal, county, state, and federal levels. If a telecommunications firm expects to make a profit by bringing internet access to a reservation, or if subsidies are available to supplement otherwise unprofitable expansions, the firm must work with a variety of officials and policies simultaneously. If a telecommunications firm or utility service wants to build within reservation boundaries, tribal officials, who implement tribal policies, and officials in the Bureau of Indian Affairs, who implement federal policies, oversee the installation of internet infrastructure. In particular, the bureau manages the rights-of-way, easement grants, leases, leasing fees, and permitting. The leases granted to utility services require fees to be paid and the fees require fair-market-value assessments to be done to ensure the lease fee is appropriate for the requested use. This lease fee can be a significant barrier for large corporate utility services to build on tribal land. Thus, the size of the leasing fee and cost of infrastructure development determine the scale and scope of the barrier to providing internet service. The tribal government does not pay lease fees for its land, but most go through permitting processes (state, county, and tribal) to build infrastructure. State and county regulations may have some jurisdiction on tribal

lands, particularly trust lands, in cases in which the state or county has been given a right-of-way. For example, tribes expect to receive a leasing fee for a right-of-way, but many companies do not want to pay the leasing fee, or the state gives the company part of the right-of-way without consultation or payment to the tribe because it is under the state's right-of-way on Indian land. This occurs primarily on state-designated highways or state-maintained roadways. Thus, the combination of tribal, county, state, and federal regulations and policies can delay the planning and permitting processes required for internet access.

Despite the economic and institutional barriers, technological innovation and policy/institutional reforms can bring the internet to these underserved areas, allowing them to access broader markets. One such technological innovation has been SpaceX's Starlink, which has brought high-speed internet service via a satellite network, eliminating the need for extensive physical infrastructure. Starlink has already proven useful for Native American tribes in remote locations. In 2020 during the beginning of the COVID-19 pandemic, Starlink connected the Hoh Tribe of Washington to reliable broadband for the first time. Tribal members were able to access education when schools were closed and telemedicine when it was difficult to visit a doctor's office (Brodkin 2020).

In 2020, leaders on California's Hoopa Valley Reservation created Acorn Wireless, which is an internet service provider that is owned and operated by the tribe's public utilities department. To create Acorn, the tribe was granted funds from the CARES Act, the Department of Commerce's Internet For All initiative, and the Tribal Broadband Connectivity Program. Acorn has built internet relay towers and a fiber network that is intended to eventually reach all households on the reservation (Acorn Wireless 2024; Malmgren 2024).

Another innovation is to use electrical cooperatives to provide broadband internet. Electrical cooperatives are customer-owned, nonprofit organizations that provide electricity to many rural parts of the US, including reservations, that would otherwise be underserved by traditional electric companies. These co-ops either return profits as dividends to members or invest profits in infrastructure. Since electric cooperatives build infrastructure for electricity, they can also bring broadband to rural areas by bundling electric and fiber optic infrastructure together. Many co-ops are engaged in smart-grid modernization projects in which they retrofit or upgrade utility poles with fiber. Co-ops also have the personnel, skills, and equipment that

can fairly easily be shifted to serve broadband customers. In the past few years, some states have passed new legislation or enacted new policies that expanded co-ops' authority to provide broadband (Read and Gong 2022).

Last, policy/institutional reforms will be necessary to improve internet access on reservations. Although there are many potential reforms that could improve governance on reservations, we highlight one underappreciated potential reform here: decision-making authority regarding rights-of-way near roadways on reservations. In short, tribal and Bureau of Indian Affairs policies for granting rights-of-way, easement grants, and leasing fees (particularly the fair-market-value requirements) will need to be streamlined and reevaluated to minimize the costs of bringing the internet to reservations. Fiber optic cables are still one of the most common and most cost-effective ways to bring broadband internet to reservations. Without clear and simple rules regarding rights-of-way, it can become prohibitively costly to lay fiber optic cables. Under the current system, a state or county can work with the Bureau of Indian Affairs to grant a right-of-way to a utility company along a road without direct communication to a tribe, even though it is on tribal land. Then, if the tribe wants to install cables later, the tribe can be forced to use land farther from the roadway, which can have more difficult topology, such as solid rock, driving up the costs. With more direct decision-making authority over infrastructure, tribes could be assured of access to rights-of-way.

V. Case Study: Expanding Internet Access on the Colville Reservation

A. Setting the Stage

In this section, we discuss the process of expanding broadband internet access on Washington State's Colville Reservation between 2010 and 2014. The purpose of this section is threefold: (1) to document a real-world technological innovation that expanded internet access to a Native American community, (2) to analyze regulatory barriers to internet access on tribal lands, and (3) to describe the socioeconomic effects of expanded internet access on a particular tribal community. While this case study of the Colville Reservation might not be representative of every reservation in the United States, it offers insight into other reservations in similarly isolated locations with similar regulatory and land-tenure institutions and a relatively low rate of broadband access. For instance, the Navajo Reservation—one of

the most populous reservations—had a broadband subscription rate of only 33 percent in 2021 (Mejia 2024). Thus, the Colville Reservation experience could be instructive for the Navajo Reservation or others that face similar barriers.

This section documents the personal experiences and testimony of James Ronyak, one of the authors of this paper, who served as the chief information officer of the Colville Reservation from 2012 to 2014. Ronyak's experiences give him a unique, firsthand perspective on the challenges and strategies involved in expanding internet access within an underserved Native American community. This documentation serves to illustrate how decision-makers interact with and navigate governance institutions and the critical role these institutions play in facilitating or impeding advancements in internet access. Ronyak's insights suggest ways in which tribal decision-makers can adopt entrepreneurial strategies to initiate and implement innovations that yield social benefits. This section aims to contribute to a broader understanding of the ways real-world actors work within—and sometimes around—institutional barriers to address pressing community needs.

One of the principal reasons the tribe hired Ronyak was to bring reliable high-speed internet to the reservation. During his time as chief information officer, Ronyak oversaw the technical services for the Colville Reservation's government buildings, fisheries and fish hatcheries, tribal schools, state-managed public schools located on the reservation, tribal energy facilities, and tribally owned business branches.

The narrative below has several interwoven components, which we outline here for clarity. Between 2010 and 2014, the Colville Reservation's tribal leaders worked to improve cellular coverage and access to broadband internet. The two efforts started as separate but simultaneous exercises, which both proved to be difficult because of high costs, legal impediments, and harsh geography. By a serendipitous discovery, tribal officials and telecommunications workers found that the cellular-coverage issue and the internet issue could be solved with the same solution. Despite many barriers, Ronyak and other tribal leaders helped devise an innovative system of providing internet access to the reservation's residents, using mountaintop-based solar- and wind-powered communications towers that could also beam wireless internet down on the reservation. The expansion of internet access across the Colville Reservation helped make the tribal government more reliable, expanded opportunities for local entrepreneurs,

improved tribal enterprises, facilitated educational opportunities, and provided opportunities for telehealth.

The Colville Reservation is a large, rugged, and isolated area in northeastern Washington State. Like many other rural areas, its access to reliable internet and cellular coverage has been an ongoing issue. The reservation stretches across 4,412 square miles, making it slightly smaller than Connecticut. The reservation's physical geography consists of rugged mountains, pine forests, large rivers, high deserts, basalt cliffs, and rocky soil, which all pose significant challenges for utility construction. The population is roughly 7,500 people, with most living in a few small towns, such as Coulee Dam, Nespelem, Elmer City, Inchelium, Keller, Omak, and Twin Lakes. The Confederated Tribes of the Colville Reservation is a federally recognized entity that consists of twelve individual tribes: Arrow Lakes, Chelan, Colville, Entiat, Nespelem, Okanagan, Methow, Sinkiuse-Columbia, Nez Percé, Palus, San Poil, and Wenatchi.

B. Barriers to Expanding Access to the Internet and Cellular Service

In 2010, two years before Ronyak became chief information officer, tribal leaders began discussing how to improve telephone utilities and cellular coverage. The discussions between tribal leadership and the tribal community, as well as nearby nontribal communities, focused on the dangers of having virtually no cellular service on large swaths of the reservation. Especially in hazardous winter conditions, public officials, tribal members, and nontribal individuals were afraid of becoming stranded without the ability to communicate with emergency personnel. Additionally, tribal leaders and other tribal members were concerned about not having equal access to cell coverage when compared to adjacent nontribal communities.

As leaders and community members were discussing the expansion of cell service, they also began discussing the installation of broadband internet infrastructure to improve the tribe's economic, educational, and health opportunities. Before 2012, the Colville Reservation had no federally qualified broadband services available for subscription. At the time, the Federal Communications Commission determined the reservation to be a "Black Hole of Internet" because of the lack of broadband. When Ronyak began as chief information officer, the Confederated Tribes of the Colville Reservation had eight bonded T1 phone lines and rented an additional twenty-six T1 lines for other services (for example, desk-handset telephone lines, schools, department offices, fisheries, and community centers). With these

lines, the reservation's public buildings (for example, government offices, schools, casinos, and hospitals) were limited to slow and unreliable internet access (1.5 Mbps/1.5 Mbps) provided by telephone companies. Most residential houses had no access.

Slow, unreliable internet access had several negative consequences. Tribal communities could not engage in telehealth because of slow internet speeds, impairing the ability of medical professionals to help patients in this rural area. The internet at the tribe's government offices would crash frequently, causing disruptions to public services and losses of government-employee wages. Additionally, the internet service was relatively expensive for the quality of the service that was provided, which put financial strain on an already-strained tribal government. When Ronyak took over as chief information officer, the Colville Tribe's annual expense for internet services was roughly \$340,000.

Beginning in 2012, Ronyak began looking for options to expand broadband access to the Colville Reservation and found that Verizon and CenturyLink had broadband fiber connection points at the Coulee Dam Bridge, which is adjacent to the boundary of the reservation and the border town of Coulee Dam. Ronyak contacted these internet service providers to explore the potential options. However, each of the providers was hesitant to build the infrastructure necessary to bring broadband to the tribe. Building utilities on sovereign tribal land is especially difficult for for-profit corporations, like Verizon or CenturyLink, because of escalated return-on-investment costs. These costs include the building of infrastructure in rugged topography, land/building lease fees, and a complex web of overlapping regulations at the tribal, county, state, and federal levels. Thus, Verizon and CenturyLink were not willing to pay for infrastructure or leasing fees once their services crossed the boundary of the reservation because it would take too long to recover the initial investment. Additionally, the limited number of potential subscribers reduced the expected benefits relative to the expected costs.

Instead of relying on Verizon or CenturyLink to build the infrastructure, the tribe considered laying its own fiber cables. The tribal government already owned a small amount of fiber that extended from the nonreservation town of Grand Coulee, across the Grand Coulee Bridge, to the reservation town of Coulee Dam. Coulee Dam was one of the few reservation towns with preexisting fiber optic cables, but it was not connected to other towns on the reservation. This preexisting connection allowed the tribe's Coulee Dam Casino to

operate with internet access. Tribal officials began exploring the possibility of expanding fiber access across the reservation from the infrastructure in Coulee Dam. Owning the fiber was appealing to tribal officials because it would eliminate leasing fees associated with using externally owned fiber. Tribal leaders believed that with sufficient financial resources, they could install and control their own fiber network, avoiding dependence on an external provider.

Per Ronyak's testimony, tribal officials estimated that they needed to install 283 miles of cables, costing \$22,300,000. In addition to the cables, the tribe would have to install necessary electrical infrastructure, which would cost \$4,734,000. Then, the cost of labor and equipment was estimated at \$10,154,000. Thus, the research showed that installing all the necessary infrastructure for high-speed internet totaled an estimated \$37,188,000. Tribal leaders realized that they did not have such funding internally, and the only way to get the financial resources would be through grants or donations. Tribal officials applied for federal grants and received \$2,833,000. Since the grants did not cover all the costs, tribal officials had to look at other options.

Besides direct monetary costs, tribal officials faced two other costs to build new utility infrastructure. First, the topology of the Colville Reservation presented challenges regarding how to appropriately design internet services across the massive and rugged area of the reservation. Second, the complex governance structures for the reservation posed another set of challenges. Tribal leaders found that the institutional barriers came from many sources, including the Bureau of Indian Affairs, the Bureau of Indian Education, the State of Washington Department of Transportation, Ferry County, and the Colville Reservation's Tribal Code. The Bureau of Indian Affairs is responsible for coordinating and managing rights-of-way and easements with all providers. The Bureau of Indian Education is responsible for the management of all tribal schools. The Washington Department of Transportation is responsible for the additional easements on state-designated highways. Ferry County is responsible for the county highways' maintenance and easements. Last, the tribal government is responsible for issuing relevant permits on any tribal lands. All these regulatory authorities must be consulted and approve a project. Coping with tribal trust land designations also added additional steps because both the Bureau of Indian Affairs and the tribal government must grant permissions to use tribal trust land.

In 2013, Ronyak discovered that the bureau had already granted rights-of-way to all major roadways across the reservation. This left the tribe with two options. First, it could share the existing rights-of-way with all current occupants, requiring them to obtain state and county permits as well as permission from each occupant to lay new cables. Alternatively, if it could not secure these shared rights-of-way, the tribe would have to install new cables several feet beyond the existing right-of-way. However, because of the area's rocky terrain, this approach would involve costly excavation through solid rock.

Around this time, tribal officials hired an expert consultant to provide guidance on the options to improve both cellular-service coverage and broadband internet access. The approved consultants determined there were several challenges to constructing internet infrastructure, such as issues with line of sight in transmitting wireless signals, rocky rights-of-way for laying cables, and limited precreated infrastructure. The line-of-sight challenge came from tall trees, sheer cliffs, and expansive river canyons. The mountainous topology made it difficult to transmit wireless signals in an unobstructed way because of several mountaintops over five thousand feet in elevation, with tribal communities located in between the mountains. The right-of-way challenge was due to tribal, county, and state roads that had solid rock in the easements that raised costs because the tribe would have to rent rock hammers to dig the necessary conduit down the required four feet. In most places on the reservation, there was no usable preexisting internet infrastructure, such as conduit, repeaters, or cable junction boxes.

At roughly the same time, tribal officials also met with Verizon employees to discuss potential ways to increase radio signal strength or build new cell towers on the reservations. During one of the visits with Verizon, tribal officials proposed adding radios to an existing cell tower on the reservation to improve cell coverage for rural police officer safety. During some laser line-of-sight testing, it was discovered that with proper placement of a new cell tower, Verizon could direct its cellular traffic between two mountain peaks, which would allow it to transmit signals to a cell tower off the reservation roughly forty-three miles away. This discovery meant that Verizon could increase the cellular subscriber rate with relatively minimal investment, which ultimately influenced it to finally proceed with the creation of a new cellular tower.

C. Mountaintop Towers as an Innovative Solution

In July 2013, an arsonist burned down the tribal headquarters building near Nespelem, destroying much of the tribal government's fiber cables. The fire pushed tribal leaders to examine the potential options and move forward with a plan to rebuild and expand internet access. Upon careful review of expert recommendations, the tribal officials made the decision to build internet utilities in two ways: wirelessly and through fiber installation. Wireless microwave transmission overcame the problem of going through the ground; an over-the-air approach would allow the utility service to go over the mountains. The wireless microwave installation was cheaper and provided a faster way to recoup costs.

Tribal officials discovered that the wireless utility equipment could be installed at tribally owned fire watchtowers located near or at the top of several large mountain peaks within the Colville Reservation boundaries. During this time, Verizon's lease was expiring on the reservation's Omak Mountain, which led the tribe to look for ways to reestablish the lease. Tribal officials wanted to establish their own infrastructure that they could control, and the efforts to renew the lease on Omak Mountain led them to consider building their own comms tower there and on several other mountains across the reservation.

The tribe began constructing infrastructure upgrades on Omak Mountain and Keller Butte. The Colville Tribe hired a structural engineer, Industrial Communications, to obtain and pass load-bearing certification for the new infrastructure, which then allowed the tribe to gain the fire-watch team's permission to use the watchtowers to house signal dishes. The tribal government obtained the necessary certifications and permissions, but the next hurdle was to get electricity and equipment up to the watchtower for installation and configuration. Keller Butte was centrally located to all four voting districts, which meant it was the best fit for a new comms tower. However, the tribe would need to install 4.7 miles of hardline electrical wiring from the valley below up to the watchtower. The public utility district initially quoted the tribe \$4.7 million to install the electrical cables, which was largely because of the rocky ground and steep inclines. This initial quote was not feasible for the tribe.

By coincidence, one day in 2013, during regular maintenance at the fire watchtower, Ronyak realized that wind and solar power could be used to power the comms equipment. After researching the options to create viable power, the tribal officials built a solar-panel

grid consisting of eight panels beside the tower, which was then connected to an electrical panel inside the communication hut. The solar panels were automated to adjust their angles based on time of year to optimize light exposure. After initial setup, the grid created 49,000 kW per day.

Because of the inherent limitations of solar power, this configuration was unable to generate electricity at night. To overcome this problem, the tribe conducted a wind survey to see if a wind turbine could generate sufficient electricity to make up for the limitations of the solar panels. The wind survey determined that the average wind speeds were sufficient to justify building wind turbines as a supplement to the solar panels. However, solar and wind power produce direct-current electricity, but the cellular-tower equipment required alternating current. Industrial Communications installed an inverter to convert electricity from direct current into alternating current. Based on these numbers, Ronyak calculated that each “comm hut” would cost \$144,000 fully installed with self-generating power.

Officials soon discovered that the solar and wind power were not sufficient. During November 2013, a storm blocked the sun on Keller Butte’s solar array, and there was not enough wind to keep the comms equipment operational. The comms tower became disabled for several hours. This vulnerability prompted the tribal government and its advisers to install a wall of batteries for electrical storage at times when the solar panels and wind turbine could not generate power. Upon completion of the battery wall, the system was able to remain functional in all conditions. For extreme emergencies, the tribe also installed oil-based generators to supplement battery backups, allowing the comms towers to be self-sufficient for up to three days. Additionally, the wireless dishes of the comms tower were self-heating to avoid rain fading and ice buildup, which mitigated weather-related disturbances.

The completed configuration of the mountaintop comms tower proved successful. The Colville Tribe information technology department reproduced this configuration across five other fire watchtowers on different mountains. This allowed a grid of wireless dish arrays to send internet at over 100 Mbps/100 Mbps to each of the tribal communities located within the Colville Reservation boundaries. The wireless array transmitted the internet into local community centers, which had preexisting computer labs available for the community members to use.

Even though the new wireless array was largely successful, it was not perfect. Its reliability was affected by weather and line-of-sight issues. Fiber optic cables are a more reliable alternative, so the Colville Tribe business council decided to expand the amount of fiber across parts of the reservation. After an extensive review of blueprints and interviews with Coulee Dam city officials and public utility district officials, the city council granted permission to run fiber from the casino over low-voltage telephone lines on existing poles to the outside of town. The cost to run the fiber the next fourteen miles to the town of Keller was \$1.6 million, but the Confederated Tribes of the Colville Reservation did not have an economic development arm with a large-enough surplus to finish the project. Tribal officials applied for the Department of Agriculture's Community Connects grant, which they received. The Colville Tribe initially funded the work, and after the work was approved, the tribe was reimbursed.

The tribe proceeded with laying fiber optic cables, but the process was slower and more costly than initially expected for three reasons. First, the local geology was rocky, meaning that digging the trenches to lay the cables was labor intensive. Second, the tribe had to secure highway rights-of-way and easements from the relevant governments and lessees. Third, the grant from the Department of Agriculture stipulated that federal officials had to complete periodic inspections on the project's quality of work. Despite the challenges, the fiber project provided reliable high-speed internet in the Keller Community Center.

When this round of infrastructure investments was completed in 2014, the total cost to the Colville Reservation was approximately \$682,000, as reported by Ronyak. This figure includes the full costs for building the six mountaintop towers, including the towers' physical structure, solar panels, generators, and wind turbines, as well as the associated fees and licenses.

D. The Effects of Broadband Internet Access on the Colville Reservation

The combination of mountaintop comms towers and fiber optic cables vastly expanded internet access on the Colville Reservation, although many places still lack reliable internet access. It is difficult to accurately quantify the benefits of the initiative now because of the long-term nature of the benefits and the lack of accessible records regarding income for private and tribal businesses. However, we provide anecdotal evidence based on Ronyak's testimony, which suggests that

internet access has helped to improve economic outcomes directly through expanded businesses and employment opportunities, as well as indirectly through more opportunities for education and health care. Additionally, internet access has begun to improve democratic accountability and tribal-government transparency because tribal council sessions are recorded and uploaded to the internet. Future research would be helpful in providing a quantifiable and accurate measure of the benefits that have arisen from expanded internet access on the Colville Reservation.

Based on anecdotal evidence, education and human capital formation have been positively impacted. K–12 students and high school graduates have been able to access online classes, online degree programs, and the Running Start program. The tribe converted Nespelem Elementary School to high-speed internet, which allowed the school to provide more educational services. Per Ronyak's testimony, several tribal members who did not graduate from high school have used online learning to finish a degree. Additionally, the installation of wireless infrastructure and fiber also contributed to human capital in the form of skills, which will likely contribute to economic development. During the installation of the fiber cables, the Tribal Employment Rights Office provided training to tribal members in wireless microwave technology and internet infrastructure maintenance. The office's purpose is to provide ongoing training for tribal members to get them employment opportunities. The office also ensures that tribally owned businesses get the first chance at tribal contracts and requires each contract to employ tribal members. In the first classes, thirty tribal members learned about microwave-technology maintenance, tower climbing, and green-energy installations, providing them with marketable skills.

In terms of health care, tribal officials set up private computers in each community center, which allowed local tribal members flexibility in seeing doctors remotely through telehealth. Telehealth has been especially helpful on the Colville Reservation because of heavy snowfall in the winter that makes travel difficult and potentially unsafe. Although there is not conclusive evidence that internet access has improved health outcomes on the reservation, it seems likely that faster and less expensive access to health care has had and will continue to have positive impacts on health outcomes.

Expanded internet access has created an environment where previously unviable enterprises—both private and tribal—can be started. Immediately following the completion of the new internet infrastructure

in 2014, individuals launched online businesses or promoted their in-person business online, which included music, art, clothing, and ironwork. As is common with small entrepreneurial ventures in rural areas, many of these original small businesses have either failed or merged with others since 2014. But now, with internet access, new generations of potential entrepreneurs can take advantage of the opportunities that they are alert to, whether the enterprises are large or small, short term or long term, primary income sources or side gigs.

Perhaps more influential than small private enterprises, various tribally owned enterprises have greater reach and a broader set of potential opportunities because of expanded internet access. As of 2024, Colville's tribal enterprises included several casinos, fuel stations, general stores, a credit corporation, a newspaper, a lakeside resort, and licenses for hunting, camping, and fishing (Colville Tribes 2024). Ronyak reports that shortly after internet access was expanded on the reservation, the tribal government formed a new business in the information technology sector called CCT Network, which would not have been possible without reliable high-speed internet. This business included services for two-way-radio maintenance and configuration, cabling and fiber work, and copier repair. Because of financial and legal constraints, CCT Network was merged with the Colville Tribal Federal Corporation in 2020. As of early 2025, the corporation currently manages two enterprises, including gaming and logging/wood products (see Colville Tribal Federal Corporation's website for more information). Moving forward, expanded internet access will allow tribal officials to experiment with a wider range of potential ventures that provide revenue for the confederated tribes, as well as employment and training opportunities for tribal members.

Despite improvements in the direction of reliable high-speed internet, many places on the Colville Reservation still lack access, even in 2025. The town of Inchelium is isolated on the eastern side of the Colville Reservation and has some of the most limited internet coverage in eastern Washington. Some places in and near the town are out of range of wireless towers, and cellphone coverage is spotty. New innovations, like Starlink, are providing alternative options for access, but they can be costly. For instance, Brandi Jo Desautel, paraprofessional at Inchelium High School, installed a Starlink dish in front of her trailer outside Inchelium. However, the equipment cost \$700, and the monthly service fee is \$120, posing significant barriers to less wealthy residents. Desautel has used her Starlink access to pursue an online degree in special education and support her twin daughters

with their schoolwork (Hanlon 2023). Additionally, in 2022, the Biden administration granted the Colville Reservation over \$48 million under the Broadband Infrastructure Deployment project in order to install fiber that would connect 2,867 unserved Native American households on the reservation (National Telecommunications and Information Administration 2022).

The experience on the Colville Reservation is an instructive case study for several reasons. First, the combination of serendipity, entrepreneurial alertness, and ingenuity created an innovative system to bring broadband internet to the reservation, which would have otherwise been stuck with slow or no internet connectivity. Second, institutional and regulatory barriers made it difficult and costly to bring high-speed internet to the reservation. Institutional reforms that streamline the processes for permitting, reviews, and so on could lower the costs of bringing the internet to other underserved reservations. Third, Colville Reservation residents have seen some positive socioeconomic effects from expanded internet access, but more access will be necessary in the remaining underserved communities. It is too early to say what the long-term consequences will be, but anecdotal evidence suggests that access to reliable, high-speed internet will contribute to faster and more robust economic development on the Colville Reservation.

We acknowledge that our evidence on the effects of internet access on the Colville Reservation is anecdotal, but it is instructive. Future research could do a more thorough analysis on the outcomes on the Colville Reservation, such as statistically comparing economic outcomes before and after internet access was expanded. Future research could also compare the Colville Reservation with other successful cases in the United States or other countries, such as instances in which underprivileged communities have been integrated into the digital economy. We see this case study as just the first step in understanding the governance institutions on reservations, how those institutions affect internet access, how technological innovations can overcome institutional barriers, and the outcomes from expanded access.

VI. Conclusion and Implications

Native Americans, especially those who live on reservations, experience disproportionately high rates of poverty and unemployment, among many other social problems. One of the most effective ways to address these problems is to boost economic growth on and around

reservations. Economic growth is an ongoing process in which entrepreneurs and consumers can access national and international markets. In this paper, we have argued that the internet is an important tool for development because it facilitates (1) individual Native Americans who want to start businesses, (2) tribal governments that own tribal enterprises, and (3) off-reservation businesses that want to sell to or employ tribal members. Additionally, internet access provides a wider array of opportunities for education and telemedicine, which can improve the human capital of Native Americans and indirectly contribute to economic growth.

Despite the likely contributions of reliable, high-speed internet to Native American economic development, significant barriers exist that make internet access difficult to provide. Innovations in technology and reforms to public policies have been and will continue to be important in increasing internet access on and near reservations. Bureau of Indian Affairs leasing processes and the profitability of traditional internet-service-provider infrastructure are two significant barriers that tribes face, making tech innovation one of the only ways that the internet can be brought to Native Americans on rural reservations. Starlink, tribally owned internet service providers, and co-ops are just a few innovations that are helping to provide underserved Native communities with reliable, high-speed internet. Satellite-based internet access will be especially important for attaining equitable outcomes, particularly for Native Americans who practice self-reliance and live “off the grid.” As the case study of the Colville Reservation shows, expanding access allows private businesses to spring up, education opportunities to expand, and telehealth to become viable, improving the prospects for long-term, sustainable economic growth.

This research has at least three implications. First, policy makers at the tribal, state, and federal levels should review institutions that hinder the expansion of internet access. Policy makers should look to eliminate unnecessary red tape and streamline permitting processes to ensure that telecommunications infrastructure can be installed at the lowest possible cost. If costs are kept artificially high through inefficient policies, it will continue to be difficult to address the persistent poverty on reservations. Although we cannot give detailed policy recommendations here, here are a few general suggestions for policy makers to consider. Federal officials could provide a menu of potential options for expanding internet access and step-by-step guidance on how to proceed with implementing each of those options.

The Bureau of Indian Affairs could also consider streamlining and simplifying the process of obtaining rights-of-way on trust land. The bureau's current right-of-way checklist can be difficult to navigate for a non-expert because it includes various kinds of documentation: applicant's letter of intent, tribal resolutions, landowners' consents, survey plats, environmental-compliance documents, and fair-market-value determinations by the bureau, among others. By reducing the potential transaction costs of obtaining rights-of-way, federal and tribal officials can facilitate the expansion of telecommunications infrastructure.

Second, sovereignty is the key to economic development because tribes have the regulatory "wiggle room" to try things out. Casinos, tobacco companies, and fintech firms have been successful because of this regulatory freedom. With the combination of the internet and institutional reform, both individual and tribal entrepreneurs will have the freedom to discover and exploit opportunities for economic development. Many tribal communities now are creating economic development councils to push the borders of their business profile beyond the boundaries of the reservation. Because of economic shifts, many tribal communities are attempting to expand and diversify their portfolios away from traditional tribal economic business pursuits to art, education, clothing, music, film, and more. Exercising tribal sovereignty can facilitate innovation and the creation of entrepreneurs in Native communities. However, it is important to note that there are many tensions and trade-offs within tribal enterprises. One question is whether tribal businesses are for generating revenue, for providing job training and job opportunities, or both. If the answer is both, there will be undeniable trade-offs because the most revenue-maximizing course of action might not be the most conducive to job training and job opportunities for tribal members.

Third, there are dangers of overregulation once a tribal business is successful. By expanding internet access, tribes might find that privately and tribally owned businesses are much more lucrative than before. However, tribal officials must institutionally constrain their ability to expropriate too much wealth from private or tribal enterprises that succeed. If tribal members or tribal enterprises stumble upon a proverbial goose that lays golden eggs, they must be careful to avoid unintentionally killing that goose.

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