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ECONOMIC IMPACT

BROADBAND ACROSS TENNESSEE

2018-2022 ECONOMIC IMPACT
AND CASE STUDY ANALYSIS

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TN Department of Economic & Community Development

Center for Rural Innovation
TENNESSEE TECH

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TNECD ECONOMIC IMPACT 2018-2022

BROADBAND INFRASTRUCTURE GRANTS

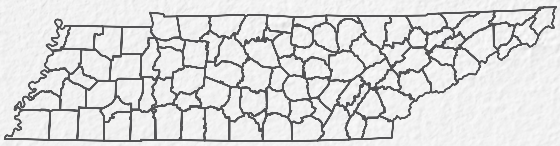
188 GRANTS AWARDED

$59M GENERATED IN STATE TAXES

1,771 TENNESSEE-BASED JOBS ANNUALLY SUPPORTED

$200M IN NEW CONSUMER BROADBAND SUBSCRIPTION SPENDING

239K NEW SUBSCRIBERS WITH A 44% AVERAGE TAKE RATE



$567M TOTAL TNECD DOLLARS INVESTED

$578,244,089

CREATED IN LABOR INCOME

$1,661,659,298

INCREASE IN TENNESSEE'S BROADBAND INDUSTRY OUTPUT

623,000

TENNESSEANS SERVED

RESEARCH PROVIDED BY TENNESSEE TECH UNIVERSITY CENTER FOR RURAL INNOVATION AND RURAL REIMAGINED GRAND CHALLENGE UTILIZING IMPLAN® CLOUD, 2022 DATA, USING INPUTS PROVIDED BY THE USER AND IMPLAN GROUP LLC, IMPLAN SYSTEM (DATA AND SOFTWARE), 16905 NORTHCROSS DR., SUITE 120, HUNTERSVILLE, NC 28078 WWW.IMPLAN.COM
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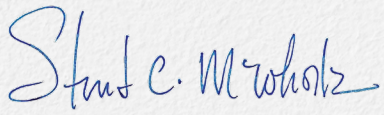
Foreword

The mission at the Department of Economic and Community Development (TNECD) is to enhance Tennessee's competitiveness by driving job creation, generating economic growth, and facilitating community development. To that end, TNECD understands broadband infrastructure and adoption resources make communities stronger, so that growth and sustainability are achieved at a community level. Our goal is to serve all Tennesseans with high-speed broadband and ensure resources are available to adapt to the technology as it evolves.

At the beginning of his term, Governor Lee signed Executive Order 1, requiring all executive departments to assess the rural impact of their services, ensuring a focus on how they work to increase prosperity and drive successful long-term economic growth to improve the lives of Tennesseans. As a result, TNECD set out to evaluate the overall effects of its programs, which began as an analysis to provide local governments and rural stakeholders with access to resources proven to advance rural economies. This economic impact analysis, completed by Tennessee Tech University, its faculty, staff and Rural Reimagined Program, has turned that focused effort into a reality.

This report outlines the success of our program, and demonstrates how broadband improvements lead to jobs, economic growth, increased state tax revenues and capital investments. The analysis shows how new investments have impacted Tennessee communities and provides exciting projections about the future investments for broadband and adoption across Tennessee.

We hope the findings in this report will help guide elected officials, policy makers, and community business leaders as they make decisions about rural and broadband investments. Tennessee's future success depends on collaboration and partnership, and we hope to continue the programs that keep our communities as front-runners for economic development.



Stuart C. McWhorter
Commissioner

Michael Aikens, Ph.D.
Director

TN Department of Economic & Community Development

Center for Rural Innovation
TENNESSEE TECH

Summary of Study Findings

This report estimates the economic impacts from the Tennessee Broadband Accessibility Act Grant Program and the Tennessee Emergency Broadband Fund Program ("Broadband Infrastructure Grants"). Overall objectives include:

- Understanding the economic impact of state administered broadband programs across Tennessee.
- Identifying the quantifiable value of the programs through economic growth, job creation, increased labor income for residents and/or overall community investment value.
- Gathering evidenced-based data for communities, legislators, and other stakeholders to support informed decision-making about future investments in broadband.

2018-2022 Broadband Infrastructure Grants Overall Projected Economic Impact to the State

The overall impact of 188 broadband grant projects from the Broadband Infrastructure Grants, from 2018-2022, totaling $1,137,746,503 in project costs includes:

- 623,623 Tennesseans served
- 239,168 new subscribers with a 44% average take rate
- $200,900,890 in new consumer broadband subscription spending
- An average of 1,771 Tennessee-based jobs supported annually
- $578,244,089 in created labor income
- $1,661,659,298 increase output in Tennessee's broadband industry
- $59,257,388 generated in state taxes

Broadband Expansion Economic Impact Research

This section describes research conducted to investigate and analyze the economic impacts resulting from Broadband Infrastructure Grants between 2018 and 2022. Tennessee Tech University's Center for Rural Innovation (TCRI) conducted the research in collaboration with TNECD's Community and Rural Development Division, who provided the requisite program data, definitions and parameters. The goals of the research and its significance to the state are threefold: i) to provide estimated economic impacts, both statewide and per-project, ii) to develop tools that assist planning, assessment, and

evaluation of state-wide and project-level grant program performance, and iii) to investigate how broadband expansion creates resiliency within Tennessee's rural geographies. This section presents the research background, methodology, and findings.

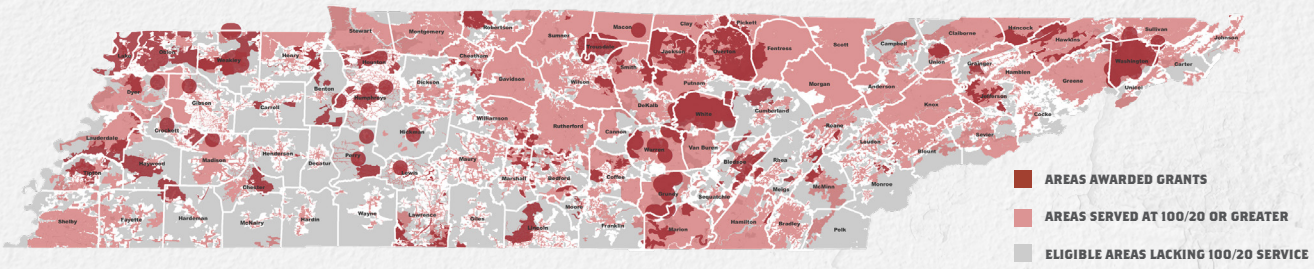
2018-2022 TNECD BROADBAND INFRASTRUCTURE GRANTS PROGRAM ACTIVITY

The Tennessee Broadband Accessibility Act ("TBAA"), passed by the Tennessee General Assembly in April 2017, established the State's broadband efforts around three main areas of focus: investment, deregulation, and education. The TBAA was the result of nearly two years of study and discussion on the part of the TNECD and the Tennessee Advisory Commission on Intergovernmental Relations ("TACIR"). Fiscal year 2022 marks the fifth year of operating under the TBAA, and significant progress has been made by facilitating broadband deployment through these grants across the state. Recovery from the COVID-19 pandemic has continued to elevate the importance of critical broadband infrastructure and connectivity in Tennessee communities. The investment component of the TBAA established the Broadband Accessibility Grant Program. A total of $60 Million was appropriated to the program over the first four years. Open to any internet provider, this technology-neutral program is designed to offset the capital costs associated with providing broadband to high-cost, unserved areas. A map of the award locations which displays served and under-served locations is provided in **Figure 1**.

In August 2020, the Tennessee Emergency Broadband Fund ("TEBF-CARES") was created when Governor Lee dedicated $61 Million of Tennessee's Coronavirus Relief Fund to broadband. In 2022, the Tennessee Emergency Broadband Fund was able to continue through the American Rescue Plan ("TEBF-ARP") funding. TEBF-ARP utilizes a portion of Tennessee's American Rescue Plan Coronavirus State and Local Fiscal Recovery Funds to make necessary investments in broadband infrastructure to help turn the tide on the pandemic, address its economic fallout, and lay the foundation of a strong and equitable recovery for the state. In the fiscal year 2022, the state's Financial Stimulus Accountability Group ("FSAG") designated $500 Million for broadband funding from the American Rescue Plan Coronavirus State and Local Fiscal Recovery Funds Program. FSAG allocated $450 Million in American Rescue Plan Funding for infrastructure and $50 Million for broadband adoption. Infrastructure projects are associated with installing and acquiring middle-mile and last-mile broadband. Broadband adoption and digital opportunity projects are designed to address affordability, digital skills training, workforce development, and interim access challenges exacerbated by the pandemic.

FIGURE 1

Map of areas awarded, served, and eligible areas for Broadband Infrastructure Grants.



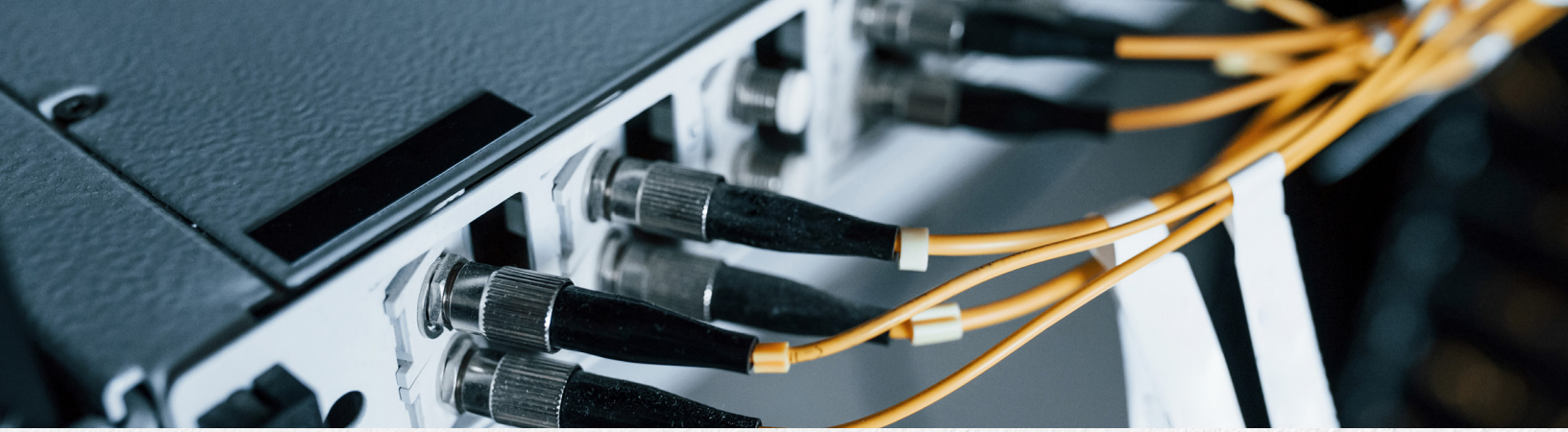


Table 1 presents the total state-wide grant activity for the Broadband Infrastructure Grants from 2018 through 2022. In summary, through these grant programs, the State-administered 188 grants to rural broadband providers that totaled $566,625,224 in state investments. Additionally, a total of $403,335,850 in match and $167,785,428 in leveraged funds were contributed to the projects. Match funds are based on program guidelines and include the amount of funds a grant recipient is required to contribute to the project. Leveraged funds include any additional funds a grant recipient is contributing beyond the required match amount. In sum, the project cost of broadband expansion in the state from 2018 through 2022 totaled $1,137,746,50.

TABLE 1

Broadband Infrastructure Grant investments 2018-2022.

INVESTMENT CATEGORY	GRANTS	TNECD INVESTMENT	MATCH	LEVERAGE	TOTAL COST
2018					
BROADBAND ACCESSIBILITY	9	$9,844,862	$7,654,151	$3,169,015	$20,668,028
2019					
BROADBAND ACCESSIBILITY	13	$14,788,311	$14,788,311	$4,646,933	$34,223,554
2020					
BROADBAND ACCESSIBILITY	16	$19,265,424	$19,265,424	$9,593,867	$48,124,714
TN EMERGENCY BROADBAND FUND	62	$61,058,468	$15,264,617	$4,250,800	$80,573,884
2021					
BROADBAND ACCESSIBILITY	13	$14,897,878	$14,897,878	$6,283,632	$36,079,387
2022					
TN EMERGENCY BROADBAND FUND	75	$446,770,282	$331,465,471	$139,841,182	$918,076,935
TOTAL:	**188**	**$566,625,224**	**$403,335,850**	**$167,785,428**	**$1,137,746,503**

METHODOLOGY

First, this study analyzed the economic impacts of Broadband Infrastructure Grant initiatives using the IMPLAN economic analysis modeling application. Next, a quantitative, deductive approach was utilized to statistically test for inferential evidence to provide empirical findings regarding the economic impact and performance metrics of the funded projects. Finally, the results of the statistical tests were used to develop tools to predict future performance, project expected economic impacts, and evaluate grant initiatives. An in-depth narrative describing the methodology and procedures follows.

KEY ASSUMPTIONS

This study includes the following key assumptions:

1. All project data provided by grant recipients are assumed to be accurate.
2. No economic modeling software can estimate economic impacts with 100% certainty; however, IMPLAN, the industry-standard economic modeling software utilized in this study, is assumed to provide reliable results within the industry and geographies studied. Additional IMPLAN input-output modeling assumptions are located on IMPLAN's website.
3. Monthly broadband subscription fees were $70 per month / $840 per year per subscriber as provided from pricing in grant applications.
4. Tennesseans served is calculated as 2.5 persons per reported passing/household.

ECONOMIC IMPACT ANALYSIS WITH IMPLAN

This study utilized the IMPLAN Cloud (IMPLAN) application to model the economic impacts of the broadband expansion programs experienced in Tennessee's wired telecommunications industry. To conduct the economic impact analysis in IMPLAN, researchers utilized a dataset that contained information about 188 broadband infrastructure projects from 2018 through 2022. Two programs, the Tennessee Broadband Accessibility Act Grant Program and the Tennessee Emergency Broadband Fund Program, were analyzed. The data from each project was individually analyzed in IMPLAN to estimate the economic impacts of these programs.

IMPLAN is an industry-leading cloud-based application that features a suite of datasets, algorithms, and input-output methodology that model the economic multiplier effects experienced by industries (such as wired telecommunications providers) in reaction to an economic event (such as grant programs and broadband adoption) occurring within a specified local economic area (Tennessee). IMPLAN provided the study with reliable data models that enabled the researchers to investigate and produce estimated economic impacts resulting from the Broadband Infrastructure Grants.

Because spending patterns vary greatly across different industry sectors, it is imperative for economic impact research to accurately represent the industry studied. The recipients of the grant funding were providers within the wired telecommunications (wired-telecom) industry. Accordingly, IMPLAN was selected for this study due to its ability to i) analyze spending patterns, ii) estimate intermediate input

ratios, and iii) produce impact models that are each customized and specific to the wired-telecom industry in Tennessee. IMPLAN's wired-telecom spending patterns and input ratios are derived from expenditure patterns provided by the U.S. Bureau of Economic Analysis (BEA) and Bureau of Labor Statistics (BLS).

The results provided by IMPLAN included the direct, indirect, and induced effects of the grant programs and the resultant consumer spending triggered by broadband adoption. The sum of these multiplier effects represents the total economic impact to the wired-telecom industry in the state.

- **Direct effects** are the initial changes in local economies as a result of spending.
- **Indirect effects** are the business-to-business purchases within the region's supply chain stemming from industry input purchases.
- **Induced effects** are the values stemming from household spending of labor Income, after the removal of taxes, savings, and commuter income.

The total economic impact of the multiplier effects can be observed across a variety of economic indicators within IMPLAN. For this study, employment, labor income, output, and state taxes were identified as the primary economic indicators of interest. TNECD's mission is to enhance Tennessee's competitiveness by driving job creation, generating economic growth and facilitating community development. The broadband indicators identified are primary measures of growth and critical to propelling economic and community development across Tennessee by deploying hign speed internet.

- **Employment** is the annual average of Tennessee-based jobs supported within the studied industries. The results are an industry-specific mix of jobs, as defined by the BEA and BLS, supported by economic events. Employment is reported in terms of averages because some jobs are sustained, and some are lost every year. The net effect is best reflected in the expression of average annual jobs.
- **Labor income** represents the total income generated by the various forms of employment income, including employee wages, salaries, and benefits resulting from economic events.
- **Output** is the value of production catalyzed within an industry, during one calendar year, in response to economic events.
- **State taxes** are the state-level taxes generated by an economic event.

Finally, there are two distinct economic events that occur as a result of broadband investments: capital investment and consumer spending. To accurately research the broadband expansion economic impacts, the capital investment and consumer spending events were each analyzed separately, then combined. Combining the impacts of capital investment and consumer spending provides the entire economic picture of the broadband expansion programs. The following sections describe the analysis approach in IMPLAN for each economic event.

CAPITAL INVESTMENT EVENT ANALYSIS

A capital investment pattern for the wired-telecom industry was utilized to analyze the impacts of

the capital investment events. The investment pattern was a collection of 97 IMPLAN commodity economic events that, together, model the wired-telecom industry's spending pattern for broadband capital investments. Total costs for each project were distributed proportionately across the investment pattern and then analyzed in IMPLAN. **Table 2** presents a summary of the total estimated economic impacts to Tennessee as a result of the capital investment events.

In summary, the capital investment events, totaling $1,137,746,503, supported an average of 1,503 Tennessee-based jobs annually, created $486,878,584 in labor income, increased output in the wired-telecom industry by $1,273,993,220, and generated $41,488,382 in state taxes. This study found that 50% of the impacts stem from Broadband Infrastructure Grants, 35% from match funds, and 15% from leveraged funds.

TABLE 2

Economic impact from Broadband Infrastructure Grant investment events 2018-2022.
*Employment total is the annual average.

YEAR	TOTAL COST	EMPLOYMENT	LABOR INCOME	OUTPUT	STATE TAXES
2018	$20,668,028	141	$9,141,490	$23,876,711	$778,396
2019	$34,223,554	232	$14,997,180	$39,191,090	$1,277,288
2020	$128,698,598	863	$55,877,916	$146,096,105	$4,760,047
2021	$36,079,387	240	$15,521,109	$40,601,529	$1,322,458
2022	$918,076,935	6,040	$391,340,888	$1,024,227,785	$33,350,193
TOTAL:	$1,137,746,503	1,503*	$486,878,584	$1,273,993,220	$41,488,382

CONSUMER SPENDING EVENT ANALYSIS

To estimate the impacts of consumer spending, an industry output event type in IMPLAN was used to measure the increase in Tennessee's wired-telecom industry's output as a result of revenues generated through broadband adoption. Industry output event types represent the change in value of industry production in response to an economic event. This study only analyzed the sales of monthly subscriptions to new subscribers. Revenues from existing customers were not included in the analysis. TNECD assumed fees were $70 per month/$840 per year per new subscriber. This study did not analyze additional associated consumer costs, such as the purchase of computers, modems, connection fees, and other related technology required to access broadband internet.

- **CONTRACTED PASSINGS:** The number of unserved locations as of the grant contract start date to be served with the grant funds within that grant location / geographical area.
- **REPORTED PASSINGS:** The number of locations the recipient has actually served in the grant location / geographical area as reported to TNECD during the grant closeout.
- **TENNESSEANS SERVED:** The number of Reported Passings x 2.5. (2.5 is the number of people per household per the United States Bureau of Labor Statistics (BLS)).
- **TAKE RATES:** The percentage of the locations (Reported Passings) in the grant location / geographical area that are subscribing to the broadband service.
- **SUBSCRIBERS:** The number of people subscribing to service within the grant location / geographical area. This is calculated by using the Take Rate, Reported Passings, and people per household as previously noted.

At the time of study, grant recipients for 2021 and 2022 projects had not yet provided reported passings and take rate reports (expected in Spring 2023). Therefore, this study analyzed project adoption activity, as reported by grant recipients, from 2018 through 2020. **Table 3** presents the reported annual broadband adoption outcomes; **Panel A** indicates that 132,233 Tennesseans were served as a result of the broadband expansion programs. Of this total, 56,370 Tennesseans subscribed to broadband resulting in an average take rate of 44% and $47,351,184 in new consumer spending. **Panel B** details the economic impacts to the State resulting from the new consumer spending, finding that new consumer spending supported an average of 117 Tennessee-based jobs annually, created $22,428,484 in labor income, increased output in the wired-telecom industry by $91,724,325, and generated $3,726,475 in state taxes.

TABLE 3 - PANEL A.
Summary of broadband adoption outcomes.

YEAR	PROGRAM	TENNESSEANS SERVED	SUBSCRIBERS	AVERAGE TAKE RATE	CONSUMER SPENDING
2018	BROADBAND ACCESSIBILITY	17,008	5,724	44%	$4,807,900
2019	BROADBAND ACCESSIBILITY	22,605	10,429	51%	$8,760,436
2020	BROADBAND ACCESSIBILITY	27,640	11,368	42%	$9,549,159
2020	TN EMERGENCY BROADBAND FUND	64,980	28,850	33%	$24,233,690
	TOTAL:	132,233	56,370	44%	$47,351,184

TABLE 3 - PANEL B.
New economic impact from consumer spending 2018-2020.
*Employment total is the annual average.

YEAR	EMPLOYMENT	LABOR INCOME	OUTPUT	STATE TAXES
2018	36	$2,295,764	$9,388,836	$381,439
2019	65	$4,162,200	$17,021,883	$691,546
2020	249	$15,970,520	$65,313,606	$2,653,489
TOTAL:	117*	$22,428,484	$91,724,325	$3,726,475

To project the economic impacts of the 2021 and 2022 consumer spending events, inferential statistics were used to predict outcomes. The succeeding Inferential Statistics section describes these statistical tests and the findings. Congruent with the adoption findings, the researchers analyzed the predicted consumer spending totals in IMPLAN. The results from the IMPLAN analysis produced projected consumer spending economic impacts. **Table 4, Panel A** presents the projected broadband adoption outcomes for 2021 and 2022. **Table 4, Panel B** details the projected economic impacts resulting from the predicted broadband adoption outcomes.

TABLE 4 - PANEL A.
Projected broadband adoption outcomes for 2021 and 2022.

YEAR	PROGRAM	TENNESSEANS SERVED	SUBSCRIBERS	AVERAGE TAKE RATE	ANNUAL NEW CONSUMER SPENDING
2021	BROADBAND ACCESSIBILITY	18,581	6,912	37.20%	$5,806,155
2022	TN EMERGENCY BROADBAND FUND	472,810	175,885	37.20%	$147,743,551
	TOTAL:	493,776	189,610	37.20%	$159,272,353

TABLE 4 - PANEL B.
Projected consumer spending economic impacts for 2021 and 2022.
*Employment total is the annual average.

YEAR	EMPLOYMENT	LABOR INCOME	OUTPUT	STATE TAXES
2021	38	$2,625,375	$11,270,550	$534,791
2022	950	$66,311,645	$284,671,204	$13,507,740
TOTAL:	494*	$68,937,020	$295,941,754	$14,042,531

INFERENTIAL STATISTICS

Inferential statistics help researchers make predictions and draw conclusions based on sample data. Sample data was drawn from the broadband program dataset and the programmatic impacts obtained from IMPLAN, as detailed in the previous Economic Impact Analysis with IMPLAN section. First, these tests provided parameters to predict the performance of grant programs. Next, the results informed development program evaluation tools. This study used a combination of multiple bivariate correlations and simple linear regressions to accomplish these objectives. For all tests, a standard 95% confidence interval was utilized to determine if results were significant, e.g., a threshold of $p = .05$ or less.

CAPITAL INVESTMENT STATISTICAL ANALYSIS

This section describes the statistical tests used to make inferences about the economic impacts of the capital investment events. The IMPLAN results from 188 Broadband Infrastructure Grants were collected and statistically analyzed. This sample contained data, obtained from IMPLAN, regarding total project cost, employment, labor income, output, and state taxes for each project. As recap, the capital investment results obtained from IMPLAN estimate the economic impacts of broadband infrastructure investments for each project.

First, a multiple bivariate correlation was used to test for relationships of total project cost to employment, labor income, output, and state taxes. The results showed that each variable, except Employment, were significantly related and demonstrated very strong effect sizes of $r = .899$ and above ($p < .001$). Accordingly, a series of simple linear regressions were conducted with the statistically significant variables to determine the predictive values of one dollar of total project cost to labor income, output, and state taxes. The results of these simple linear regressions were used to develop metrics for capital investment impacts, and may be used to inform future investments. **Appendix Table A** summarizes the findings of the simple linear regression tests.

CONSUMER SPENDING STATISTICAL ANALYSIS

This section describes the statistical tests used to make inferences about the economic impacts of the consumer spending events. The IMPLAN results from Broadband Infrastructure Grants were

statistically analyzed. This sample contained data regarding total project cost, employment, labor income, output, and state taxes for each project. As recap, the consumer spending results obtained from IMPLAN estimate the economic impacts of new broadband subscriptions resulting from broadband adoption. A series of two analyses was performed. First, statistical tests were used to determine predictor values to project adoption performance for the 2021 Broadband Accessibility and 2022 Tennessee Emergency Broadband Fund projects. Next, statistical tests were conducted using data obtained from IMPLAN to determine the predictive values of the consumer spending events' economic impacts. A narrative describing these tests and their results follows.

ADOPTION STATISTICAL ANALYSIS

This section describes the statistical tests used to make inferences about broadband adoption. Obtaining adoption predictor values was necessary to project the new annual consumer spending resulting from the 2021 Broadband Accessibility and 2022 TN Emergency Broadband Fund programs. To conduct the tests, a sample of 84 grants from 2018 through 2020 was used. This sampled contained data regarding reported passings, Tennesseans served, take rates, and new annual consumer spending for each project.

First, a multiple bivariate correlation was conducted to determine if relationships exist between the adoption variables. The variables tested were total project cost, reported passings, Tennesseans served, total subscribed, and annual new consumer spending. The results indicated that all variable relationships were significant ($p < .001$) and were highly correlated, demonstrating Pearson values of $r = .554$ and higher.

Next, the researchers sought to develop a set of equations that could be used to predict adoption outcomes based on total project cost. To ensure the highest degree of prediction accuracy, the researchers used the results of the multiple bivariate correlation to select the most appropriate variables for regression testing. Variables demonstrating the strongest Pearson r relationships were selected. These variables were total project cost, reported passings, and total subscribed. Consequently, total project cost was designated to predict reported passings due to its high degree of correlation to reported passings, $r(79) = .62$, $p < .001$. Likewise, total served revealed a stronger relationship to total subscribed ($r(79) = .78$, $p < .001$) than total project cost to total subscribed ($r(79) = .55$, $p < .001$). Therefore, total served was chosen to predict total subscribed due to its stronger effect size. Then, a series of simple linear regressions were used to test the selected variables and produce prediction values. After conducting the regressions, the test results were utilized to develop equations that predict the outcomes of the 2021 and 2022 Broadband projects. The following narrative details each simple linear regression test and its results.

First, a simple linear regression was conducted to assess whether total project cost significantly predicts reported passings. The results of the regression suggested that for every one dollar of the total project cost invested, .000206 reported passings are predicted, with 95% confidence interval lower and upper bounds of .000149 and .000264, respectively ($t = 2.548$, $p < .001$).

Then, a simple linear regression was conducted to assess whether total Tennesseans served

significantly predicts total subscribed. The results of the regression suggested that for every one Tennessean served .372 subscribers are predicted, with 95% confidence interval lower and upper bounds of .305 and .438, respectively (t = 11.128, p < .001). Consequently, the predicted average take rate is 37.2%. **Appendix Table B** summarizes the values obtained from the tests.

ECONOMIC IMPACT STATISTICAL ANALYSIS

This section describes the statistical tests used to make inferences about the economic impacts of the consumer spending economic events. The IMPLAN results from 84 grant projects were collected and statistically analyzed. This sample contained data regarding total project cost, employment, labor income, output, and state taxes for each project.

First, a multiple bivariate correlation was used to test for relationships of total project cost to employment, labor income, output, and state taxes. The results showed that each variable was significantly related and demonstrated strong effect sizes of r = .552 and above (p < .001). Therefore, a series of simple linear regressions were conducted to determine the predictive values of one dollar of total project cost to employment, labor income, output, and state taxes. The results of these simple linear regressions were used to develop metrics for capital investment impacts. **Appendix Table C** summarizes the results of the tests.

ECONOMIC IMPACT CONCLUSIONS

This section presents the research conclusions of the estimated total economic impact to the state of Tennessee resulting from the broadband expansion programs from 2018 through 2022. The findings were obtained from a combination of analyzing TNECD datasets, IMPLAN multiplier outcomes, and inferential statistical tests as described in preceding sections.

The value stemming from this economic impact analysis research was to provide answers that specifically addressed broadband expansion objectives. These objectives were i) to determine the economic impacts of broadband expansion in Tennessee and ii) to develop tools that could assess and evaluate current and future broadband programming initiatives. As shown in **Table 5, 6, and 7**, the economic impacts illustrate a positive impact on the State.

These statewide impacts total $1,137,746,503 in project costs across 188 broadband grants projecting service to over 623,623 Tennesseans. The highlights also include projections of over $200,900,890 in new consumer broadband subscription spending, 239,168 new subscribers with a 44% average take rate, an average of 1,771 Tennessee-based jobs supported annually, $578,244,089 in created labor income, $1,661,659,298 increase output in Tennessee's broadband industry, and $59,257,388 generated in state taxes.

TABLE 5

Total combined economic impacts 2018-2022. *Employment total is the annual average.

YEAR	EMPLOYMENT	LABOR INCOME	OUTPUT	STATE TAXES
2018	177	$11,437,253	$33,265,548	$1,159,835
2019	296	$19,159,381	$56,212,973	$1,968,834
2020	1,112	$71,848,437	$211,409,711	$7,413,537
2021 (PROJECTED)	277	$18,146,484	$51,872,078	$1,857,249
2022 (PROJECTED)	6,991	$457,652,533	$1,308,898,989	$46,857,933
TOTAL:	**1,771***	**$578,244,089**	**$1,661,659,298**	**$59,257,388**

TABLE 6

Consumer spending economic impacts. *Employment total is the annual average.

YEAR	EMPLOYMENT	LABOR INCOME	OUTPUT	STATE TAXES
2018	36	$2,295,764	$9,388,836	$381,439
2019	65	$4,162,200	$17,021,883	$691,546
2020	249	$15,970,520	$65,313,606	$2,653,489
2021 (PROJECTED)	38	$2,625,375	$11,270,550	$534,791
2022 (PROJECTED)	950	$66,311,645	$284,671,204	$13,507,740
TOTAL:	**267***	**$91,365,504**	**$387,666,079**	**$17,769,006**

TABLE 7

Summary of adoption outcomes.

YEAR	TENNESSEANS SERVED	SUBSCRIBERS	AVERAGE TAKE RATE	CONSUMER SPENDING
2018	17,008	5,724	44%	$4,807,900
2019	22,605	10,429	51%	$8,760,436
2020	92,620	40,218	37%	$33,782,849
2021 (PROJECTED)	18,581	6,912	37%	$5,806,155
2022 (PROJECTED)	472,810	175,885	37%	$147,743,551
TOTAL:	**623,623**	**239,168**	**41%**	**$200,900,890**

Appendix

TABLE A.
Summary of capital investment impact simple linear regression test results.

PREDICTOR VARIABLE	OUTCOME VARIABLE	COEFFICIENT	LOWER BOUND	UPPER BOUND
TOTAL PROJECT COST	LABOR INCOME	0.13	0.121	0.139
TOTAL PROJECT COST	OUTPUT	0.436	0.416	0.455
TOTAL PROJECT COST	COUNTY TAXES	0.009	0.008	0.009
TOTAL PROJECT COST	STATE TAXES	0.017	0.016	0.019

TABLE B.
Summary of adoption statistical findings.

PREDICTOR VARIABLE	OUTCOME VARIABLE	COEFFICIENT	LOWER BOUND	UPPER BOUND
TOTAL PROJECT COST	REPORTED PASSINGS	0.000206	0.000149	0.000264
TENNESSEANS SERVED	SUBSCRIBERS	0.372	0.305	0.438

TABLE C.
Summary of consumer spending impact simple linear regression test results.

PREDICTOR VARIABLE	OUTCOME VARIABLE	COEFFICIENT	LOWER BOUND	UPPER BOUND
TOTAL PROJECT COST	EMPLOYMENT	0.00000109	0.000000751	0.00000142
TOTAL PROJECT COST	LABOR INCOME	0.038	0.026	0.051
TOTAL PROJECT COST	OUTPUT	0.251	0.177	0.324
TOTAL PROJECT COST	COUNTY TAXES	0.007	0.004	0.009
TOTAL PROJECT COST	STATE TAXES	0.016	0.011	0.021

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