EXECUTIVE SUMMARY

High speed broadband internet is often heralded as an effective economic development tool. To realize the purported benefits of broadband services, federal, state and local governments are investing in its expansion. However, the relationship between high speed broadband and the economic health of North Carolina communities is unknown. Using quantitative and qualitative methods, this study explores the relationship between high speed broadband and the economic health and economic development activities in North Carolina. Finally, the study provides recommendations for local governments seeking to utilize broadband as an economic development tool.
BACKGROUND AND RESEARCH QUESTIONS
High speed broadband internet (hereafter referred to as broadband), defined as a connection of at least 768 kbps downstream and greater than 200 kbps upstream, is often heralded as an effective economic development tool. Proponents argue it should enhance communities’ ability to attract new businesses and industries while retaining and improving their existing businesses. To realize broadband’s projected economic and social benefits, federal, state and local governments are investing in its expansion. In North Carolina, several governmental agencies and non-profits such as the Golden LEAF Foundation, MCNC, E-NC Authority and local governments have financially invested in building a broadband infrastructure with hopes of positive results. However, the literature on the relationship between broadband and economic growth is mixed. Some studies suggest broadband is important in stimulating economic growth while others argue proximity to urban areas is more influential than broadband in increasing economic growth. Research also suggests businesses consider broadband during the location decision process, although the absence of broadband is more important than its presence in their decision. The relationship between broadband and economic growth and broadband and economic development efforts North Carolina communities is currently unknown.

As long as these questions remain unanswered, NC local governments have little information on how their current broadband infrastructure impacts their local economy and even less information to guide their use of broadband to improve economic development efforts. This study seeks to understand the impact broadband has on the economic health of North Carolina counties and what some communities are doing to utilize broadband to improve their economic well-being through economic development efforts. To inform local governments how to best leverage broadband as an economic development tool while addressing the gap in the existing literature on broadband access and economic development this study addresses the following research questions:

How has access to high speed broadband internet affected North Carolina communities’ economic health?

How are some North Carolina communities’ using high speed broadband internet to support their economic development efforts?

METHODOLOGY
To understand the county level impact and the strategic implications of broadband on NC communities’ economies and their economic development efforts, a mixed-method, two phased approach was employed. The county level was the primary unit of analysis for phase one, while the level of analysis in phase two was the community level, which includes two counties and one municipality.

In phase one, a correlation was performed to first determine if a relationship between broadband and the economic health of communities existed. After a significant relationship was found, a multivariate regression was performed to determine the level of impact broadband has on employment growth in North Carolina’s 100 counties. Employment growth rate, a proxy for the health or performance of a local economy, from 2005 to 2010 was chosen as the dependent variable. Data were collected for the model’s nine independent variables (See Appendix B for the full list of variables).

In phase two, comparative case studies of three communities provide an in-depth understanding of broadband’s impact on economic development efforts at the community level, specifically addressing the second research question. Communities with known investments in high-speed connectivity were explicitly chosen so lessons on how to best use broadband as an economic development tool could be gained. Experts in the field identified several communities satisfying this requirement, after which a standardized selection method considering geography, jurisdictional type, economic tier level and
broadband ownership further narrowed the list of qualified communities (see Appendix A for more information). Catawba County, Rutherford County and the City of Wilson were selected based on their fulfillment of the selection criteria. Data were gathered through eleven semi-structured interviews with local government officials and other experts identified through expert selection and snowball sampling. The interviews consisted of a standard set of fifteen pre-tested interview questions. Content analysis was performed then coded for theme development.

The methodology contains inherent limitations. The standard data available for measuring broadband penetration in the United States is a scaled measure rather than an exact number of households subscribing to broadband services. In addition, data is not available at the county level prior to December of 2008. By 2008, much of the broadband infrastructure had been installed in North Carolina, thus determining the precise economic effect broadband has on economic growth is not possible with the current data.

The employment growth rate and unemployment rate data were skewed due to the financial recession between 2008 and 2010. As such, employment and unemployment growth rates were calculated from 2005-2010 to account for any variance the recession may have caused. The interviews were subject to respondent induced biases as most interviewees had a vested interest in their community’s high-speed broadband infrastructure and thus strongly believe it improves their economic development efforts. Finally, due to time and resource constraints, representatives of the business communities were not included in the interview sample. As such, secondary sources provide information on broadband’s effect on business’ location decisions.

ANALYSIS
Quantitative Analysis
Understanding how broadband currently affects the local economy fosters the design of policies and strategies that more comprehensively address issues facing broadband expansion and its relationship to the local economy and economic development efforts. For this reason, a quantitative analysis, consisting of correlations and a multivariate regression, was undertaken to explore the relationship between broadband and the overall economic health of North Carolina counties.

The correlation demonstrates a relationship between broadband and employment growth rate exists (See Appendix C for complete correlation table). The multivariate regression model (See Appendix D for full regression results), which controls for variables that typically influence employment growth indicates broadband availability does not significantly influence the employment growth rate in North Carolina counties between 2005 and 2010 (See Appendix B for complete list of independent variables).

Many factors could cause broadband’s lack of significance in predicting the employment growth rate. However, its lack of significance in the current model is at least in part due to the high level of penetration in North Carolina by 2008. As access increases, the relative level of its impact on economic growth diminishes or decreases. Thus, it is likely North Carolina has already realized the majority of the possible economic gains broadband, as it is currently measured, fosters. Henceforth it is likely broadband’s impact on economic growth will be more localized, occurring at an individual community or even sub-community level; which may not hold significance at the county level if economic gains are not widespread.

Qualitative Analysis
The qualitative analysis’s primary goal is to provide an in-depth understanding of how broadband affects economic development efforts at the community level. The case studies were compared and contrasted on the following dimensions: background and contextual information, broadband’s use in supporting
business recruitment, retention and expansion, and its use in other economic development efforts (see Appendix A for a full table analysis, Table 3).

Catawba County
Catawba County’s broadband infrastructure was primarily installed by private providers who continue to provide services to both citizens and businesses. Between 400 and 600 residents per 1000 residents have access to broadband in Catawba County.\textsuperscript{ix}

Catawba County primarily uses broadband to recruit, retain and expand businesses, specifically high-tech data centers. One interviewee explained broadband’s importance in the process in the following way: “Well, certainly with our focus on data centers, the broadband is not simply a requirement it is one of the most important priorities. Behind power, broadband availability with redundancies is the most important issue. That’s one of our three primary target markets. And so, the access to broadband is mandatory to be able to target that sector, and we’re counting on that sector as a strong component of our future economy.”

Interviewees indicated without Catawba County’s broadband infrastructure Apple would not have located there. As one interviewee said, “It’s a utility that’s expected.” In addition, the county experiences direct economic benefits in the form of jobs and capital investments as several firms responsible for fiber production are located in Catawba County.

Catawba County also uses broadband to improve the citizens’ quality of life and enable businesses to offer employees the option to telecommute, and to attract employees wishing to telecommute. As one interviewee explained, broadband enables people who want to relocate to Catawba County to do so even if their job is not located in the county. The interviewee said, “We’re finding at this point there’s a number of people relocating to Catawba County. And they’re relocating there because their job is actually giving them enough flexibility that they can work anywhere.”

Rutherford County
The primary broadband infrastructure in Rutherford County was funded and installed through a partnership with the county, the Golden Leaf Foundation and other funders, and local non-profits PANGAEA and Foothills Connect. Based out of Polk County, PANGAEA\textsuperscript{x} provides and sells fiber fostered broadband services to local government agencies, education facilities, healthcare providers, first responders and other non-profits.\textsuperscript{xi} The broadband infrastructure serves between 200 and 400 residential connections per 1000 households.

Like Catawba County, Rutherford County uses their broadband network to recruit and retain high-tech firms. Rutherford County recruited Facebook and the State Data Center, two large organizations that interviewees said would not have located there but for their broadband network. As one interviewee said, “Indirectly I can definitely say Facebook would not have located one of their server farms in Rutherford County had there not been adequate broadband infrastructure in the county. The same can be said of the state data center which is also located in Rutherford County.”

Rutherford County also uses broadband to support entrepreneurial development. A non-profit, Foothills Connect, used broadband to set up a website for local farmers to sell their produce to regional buyers. The
“Despite the economic downturn that we have been experiencing, not one person or business is using less data than they were using before the downturn. Every one of us expects to have more power, computing power, and communications power in our hands or on our desk despite the downturn. And so a community that doesn’t realize their future is tied to communications facilitated by broadband, they’re probably missing the biggest opportunity coming down the pipes.”

Similar to Catawba and Rutherford Counties, Wilson also uses broadband to attract businesses, particularly high-tech firms. However, among the three communities, Wilson is the most proactive in using broadband to retain, expand, and support existing businesses. Wilson prides itself in providing high-quality products at a low cost, competitive with private providers, through Greenlight. Interviewees indicated local businesses subscribing to Greenlight’s services realize significant monetary savings, which can then be reinvested into their businesses. In addition, Wilson also uses their network to improve the quality of life their community offers citizens. One interviewee explained the network improves quality of life in the following way, “When you’re trying to attract pharmaceutical companies, high end technical companies, their employees and their staff are going to want very good connectivity at home as well so that they can telecommute when necessary or when that’s available to them. And we can do that through our broadband network.”

FINDINGS
Broadband Does Not Significantly Impact Employment Growth Similar to other studies, the quantitative analysis suggests a strong relationship between broadband and economic health does not exist. However, some studies have found it may impact some industry sectors, such as information technology, more than others. Thus, analyzing broadband’s impact on each industrial sector could yield different results. In addition, as employment growth has been used as a proxy for the economic health of a community in this and other studies, and results have not been found, it is possible that employment growth rate is too broad or rough as a measure of economic health. Thus the use of a different dependent variable, such as the number of new business startups, could yield different results. Indeed, the qualitative analysis suggests there is a stronger relationship between broadband and a community’s economic health than the quantitative analysis demonstrates.

Broadband is Important in Attracting and Retaining Businesses The qualitative analysis’s most significant finding is that broadband is used as a business attraction and retention tool by local government leaders involved in the business recruitment and retention process. Similar to findings from the literature, the case studies’ findings suggest broadband ranks as important as water, sewer and electricity to communities as they work to attract and retain businesses. All eleven interviewees indicated
they viewed broadband as a utility or an essential part of their basic infrastructure in their communities and they use broadband to recruit businesses. Specifically, they all use broadband to target high-tech data centers and firms. They do so through a variety of means, but primarily by providing information about their broadband system’s speeds, rates and access. Each community stressed the importance of a high-quality broadband system with the capacity for high-speed uploads and downloads in attracting high-tech industries.

All three communities also use broadband as a tool in aiding business retention and expansion, albeit less so than it is for business attraction. Interviewees from Catawba and Rutherford indicated the proliferation of broadband contributes to business satisfaction and enables expansion, thus improving business retention and expansion efforts.

While it is evident broadband is important in business recruitment, retention and expansion, its importance relative to other factors influential in business location and expansion decisions is unclear. Some respondents indicated broadband was the most important factor in recruiting certain businesses while others believed it was important to have, but was not the most important factor. As one respondent stated, “I’ve had some other industries who have said it was not a significant factor or deciding factor, but was among the factors that led to their decision to locate.” Conversely, interviewees from Catawba and Rutherford County indicated that without their broadband infrastructure neither Apple nor Facebook, respectively, would have located in their communities.

While it is unclear whether broadband is more important than other business location decision factors, it does create a serious disadvantage for communities without an existing adequate infrastructure. As one respondent said, “If it (broadband infrastructure) is not there, they (businesses) won’t locate there.” Similar to findings in the literature, the negative impact of not having broadband availability is more significant than the positive impact of having such broadband availability. Businesses view it as an essential utility or piece of the infrastructure that needs to be present or they will not locate there. Thus, broadband’s absence is more significant as a deterrent than its presence is as an attraction for businesses.

**Broadband Can Support Other Economic Development Activities** The qualitative analysis suggests broadband also affects non-traditional economic development activities or strategies such as entrepreneurial development and attracting quality employees improving citizens’ quality of life. Several interviewees noted broadband improved their citizens’ quality of life through the provision of faster internet access, and the provision of the opportunity to telecommute. As an interviewee from Wilson explained the opportunity to telecommute is particularly important in attracting pharmaceutical and high-tech firms because their employees want and expect to be able to telecommute if permitted.

**CONCLUSION**

Using quantitative and qualitative methods, this study explores the relationship between broadband and the economic health and economic development activities in North Carolina. While the quantitative data indicate that there is no significant correlation between employment growth rate and broadband in North Carolina’s counties, the case studies demonstrate that there is more to the story. Broadband may not impact total employment growth at the county level, but at a more local level, it is influential. As an interviewee said, “It particularly matters to those who either do not have an existing broadband network, or whose network does not meet the community’s needs.” Understanding broadband’s utility as a business recruitment, retention and expansion tool, as well as its ability to serve as an economic development tool in other ways can aid North Carolina communities in improving their overall economic health and become a competitive player in the local, state, national and global economies.
ENDNOTES


iv Studies by: Czernich, Ford and Koutsky, Koutrompis, and Lehr. See bibliography for full citations.


vii For the purposes of this study, community(ies) is defined as a county or a municipality.

viii For the purposes of this paper it can be assumed communities, counties and other jurisdictional reference explicitly refer to communities within North Carolina.


xi Tier level is assigned by the NC Department of Commerce based on the county’s economic well-being as defined by the NCDOC. [http://www.nccommerce.com/research-publications/incentive-reports/2011-county-tier-designations](http://www.nccommerce.com/research-publications/incentive-reports/2011-county-tier-designations)

xii FCC Form 477 measures Residential Fixed High-Speed Connections at least 768 kbps downstream and greater than 200 kbps upstream per 1000 Households (BTOP/BIP Definition) on a scale of zero to five on the following scale: 1=Greater than 0 and less than/equal to 200 households connected per 1000 households 2=Greater than 200 and less than/equal to 400 households connected per 1000 households 3=Greater than 400 and less than/equal to 600 households connected per 1000 households 4=Greater than 600 and less than/equal to 800 households connected per 1000 households 5=Greater than 800 households connected per 1000 households


xiv The correlation for broadband penetration and employment growth was .327

xv For example, a 2007 e-NC Authority report found that at that time broadband was available to 79.64 % of residents in rural counties and 86.98% of residents in urban counties.

When Broadband measures move to the National Broadband Plan standards, things will change again because a large jump in broadband speed will occur (it goes up to 4 mbps).

As of December 2010. From FCC Form 477. The date is the same for Rutherford County and the Wilson.

PANGAEA is an acronym for, “Polk Area Network for Government, Academic and Enterprise Activities”


Availability is measured at the County level as it is not available at the City level.

As measured by total employment growth rate


Improving the quality of life in a community can be a means to attract citizens and businesses.
ACKNOWLEDGEMENTS

I would like to recognize and thank my committee members: Shannon H. Tufts (chair), William Lambe, and Jonathan Morgan. I am very thankful for their time, helpful feedback, guidance and support. Each member gave vital support to me during this research process. I am especially grateful to Shannon Tufts for serving as a mentor to me throughout this process and over the past year. I would also like to thank Stacey Hypes and Maurice Ferrell, my colleagues from the Center of Public Technology, for their continued support during this process. I would also like to thank my friends, family, and my son, Grayson, for not always throwing things at my computer so I could find time to complete this research project.
BIBLIOGRAPHY


APPENDIX A: CASE STUDY INFORMATION

SELECTION CRITERIA

- Municipally owned: Does the municipality own the broadband infrastructure/network?
- Non-profit owned: Does a local non-profit own the broadband infrastructure/network
- City: Is the community a city?
- County: Is the community a county?
- Geography: Where is the community geographically located in the state?
- Tier: What state designated economic tier is the county?

Chosen Case Studies Fulfillment of Selection Criteria, Table 1

<table>
<thead>
<tr>
<th></th>
<th>Municipally Owned</th>
<th>NPO</th>
<th>City</th>
<th>County</th>
<th>Geography</th>
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<tr>
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<td>yes</td>
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Descriptive information, Table 2

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<tr>
<th>Case Study</th>
<th>2010 Population</th>
<th>Geographic Location</th>
<th>Designated Economic Tier</th>
<th>Residential Broadband Availability (DEC '10)</th>
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<td>Catawba County</td>
<td>154,358</td>
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<td>2</td>
<td>between 400 &amp; 600 connections per 1000 residents</td>
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<td>Rutherford County</td>
<td>67,810</td>
<td>Southwest</td>
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<td>between 200 &amp; 400 connections per 1000 residents</td>
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<td>City of Wilson</td>
<td>49,167</td>
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Case Study Analysis, Table 3

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<tr>
<th>BUILDING OF INFRASTRUCTURE</th>
<th>PROVIDER(S)</th>
<th>AVAILABILITY</th>
<th>USE IN BUSINESS RECRUITMENT, RETENTION AND EXPANSION</th>
<th>USE IN OTHER ECONOMIC DEVELOPMENT ACTIVITIES</th>
</tr>
</thead>
</table>
| CATAWBA COUNTY            | • Built by private providers  
• Larger businesses laid their own fiber | • Private providers (i.e. AT&T, Charter etc.) | • Between 400 & 600 connections per 1000 residents | • Attracting high-tech data centers such as APPLE  
• Attracting other firms | • Improving quality of life for citizens  
• Affords residents opportunity to telecommute |
| RUTHERFORD COUNTY         | • Built through public private partnership  
• Funded by federal and local grants | • Non-profit’s | • Between 200 & 400 connections per 1000 residents | • Attracting high-tech data centers such as Facebook  
• Attracting other firms | • Supporting entrepreneurial development  
• Farmer’s Fresh Market Program |
| CITY OF WILSON            | • Built by the city and private providers  
• Greenlight, a division of the city  
• Private providers | • Between 400 & 600 connections per 1000 residents | • Attracting high-tech firms  
• Supporting existing businesses’ infrastructure | • Attracting employees  
• Saving businesses money |
# APPENDIX B: INDEPENDENT VARIABLES USED IN STATISTICAL ANALYSIS

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLE</th>
<th>OPERATIONAL DEFINITION</th>
<th>DATA SOURCE</th>
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<td>Broadband Penetration</td>
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<td>FCC Form 477</td>
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<td>Proximity to Urban County</td>
<td>Adjacent or not adjacent to an urban county</td>
<td>North Carolina Rural Economic Development Center, 2000</td>
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<td>Projected Education Level</td>
<td>Percent of county population 25+ with a bachelor’s degree or higher</td>
<td>North Carolina Department of Commerce, EDIS County Data, 2010</td>
</tr>
<tr>
<td>Population Density</td>
<td>Population per square mile</td>
<td>North Carolina Department of Commerce, EDIS County Data, 2010</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>Median Household Income ($)</td>
<td>American Fact Finder, U.S. Census Data, 2010</td>
</tr>
<tr>
<td>Annual Average Temperature</td>
<td>Average annual temperature (F)</td>
<td>North Carolina Department of Commerce, EDIS County Data</td>
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<tr>
<td>Average Unemployment Rate</td>
<td>Average of unemployment rate, for 2005-2010</td>
<td>Employment Security Commission of North Carolina, 2005-2010 average</td>
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## APPENDIX C: CORRELATION TABLE

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<thead>
<tr>
<th></th>
<th>Employment Growth Rate 05-10</th>
<th>2010 Broadband penetration</th>
<th>Proximity to urban counties</th>
<th>2010 Projected Educational attainment rate</th>
<th>2010 Population density</th>
<th>2010 Median household income</th>
<th>Annual average temperature</th>
<th>Unemployment rate 05-10</th>
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<td>328</td>
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<td>001</td>
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<td>100</td>
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<td>137</td>
<td>328</td>
<td>339</td>
<td>.486</td>
<td>-.020</td>
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<tr>
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N = 100
## APPENDIX D: REGRESSION ANALYSIS RESULTS

### Model Summary

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<th>Model</th>
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### Coefficients

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<th>Standardized Coefficients</th>
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<td>.106</td>
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<td>Proximity to Urban County</td>
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<td>.003</td>
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<tr>
<td>2010 projected educational attainment rate, 25+ with bachelors or higher</td>
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<td>2010 Population density</td>
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</tr>
<tr>
<td>2005-2010 Unemployment rate</td>
<td>-2.396</td>
<td>-.534</td>
</tr>
</tbody>
</table>
1. What role does your organization have in bringing businesses or fostering business expansion in your community?

2. What role does your organization have in other economic development activities in your community?

3. “Please describe the current status of your community’s broadband infrastructure including availability? affordability? speed?”

4. In what ways does your community use the broadband infrastructure for economic development?

5. When you are attempting to recruit businesses to your community, what do they say they require in terms of broadband infrastructure (cost? speed? access?)

6. If I were to visit an existing business on main street in your community, what would the business owner say about your community’s existing broadband infrastructure, particularly as it relates to the success of their business?

7. What do businesses who are considering locating to your community say about how broadband infrastructure affects their location decisions?

8. What economic development benefits (if any) has your community realized due to the broadband infrastructure?

9. How might other communities leverage broadband technologies to their advantage in terms of improving economic development prospects?

10. How does your community advertise your broadband infrastructure?

11. How many businesses have located in your community in the past year?

12. How many businesses have located in your community in the past 2-5 years?

13. How many businesses have expanded their business in the past year?

14. How many businesses have expanded their business in the past 2-5 years?

15. Who else should I talk to?
APPENDIX F: CODING TREE

1. BROADBAND
   a. Quality
   b. Speed
   c. Access
      i. Availability
      ii. Cost
      iii. Anchor tenants
      iv. Providers and deployers

2. ECONOMIC DEVELOPMENT
   a. Activities
      i. Businesses
         1. Expansion
         2. Retention
         3. Attraction
      ii. Organization’s role
         1. Organizational structure
         2. How they impact ED activities

3. BROADBAND AND ECONOMIC DEVELOPMENT
   a. Broadband’s effect on Economic Development
      i. Businesses
         1. Expansion
         2. Retention
         3. Attraction
         4. Success
         5. Influence
      ii. Unanticipated benefits
   b. Broadband as an economic development tool
      i. Utility
      ii. Infrastructure
      iii. Competitive advantage
      iv. Marketing/advertisement