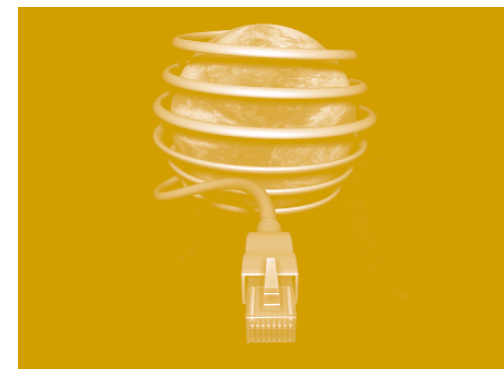# Assessing a State's Readiness for

Global Electronic Commerce:

Lessons from the Ohio Experience

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The PricewaterhouseCoopers Endowment for
The Business of Government

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January 2001

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Foreword

January 2001

On behalf of The PricewaterhouseCoopers Endowment for The Business of Government, we are pleased to present this report by J. Pari Sabety and Steven I. Gordon, "Assessing a State's Readiness for Global Electronic Commerce: Lessons from the Ohio Experience."

During a time of much discussion of the "new economy," Ohio is the first state to take on the challenge of developing a methodology and analytic tools to assess its readiness for global electronic commerce. This report outlines the methodology, process, and tools developed for assessment of a state's readiness and capability for e-commerce. The project focused on four outcomes: identify gaps in infrastructure and utilization of the technology; develop action agendas aimed at improvements in Ohio's digital economy; analyze regional strengths and weaknesses; and gauge progress in meeting e-commerce readiness goals.

This approach provides a model for other states to use in measuring their readiness to move into the new economy of the 21st century. We trust that this work will enable other states to undertake assessments of their own readiness for global e-commerce, and will assist them in developing concrete action agendas for information technology sector advancement to attract and retain jobs and foster wealth creation.

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Executive Summary

This study outlines a statewide leadership initiative to measure Ohio's readiness for global electronic commerce. The effort was the result of a public-private initiative convened by the Technology Policy Group (TPG) at Ohio Supercomputer Center (OSC), with the cooperation of PricewaterhouseCoopers.[1] It assessed Ohio's competitiveness in the new networked economy and developed concrete action agendas for information technology sector advancement in the state of Ohio to attract and retain jobs and foster wealth creation.

Ohio as a state and its major cities have been racing to promote e-commerce. Ohio's metropolitan areas, such as Cleveland, Columbus, and Cincinnati, are relatively well served by the information infrastructure, enabling global electronic commerce. However, the transition has not been smooth and has left some smaller enterprises and non-urban regions of the state behind.

Historically, Ohio has invested in new computing and information technologies with alacrity. The Ohio Supercomputer Center is an example of this pattern.[2] Electronic commerce will be a key driver of the new economy in Ohio. Mastery and rapid

adaptation of e-commerce capabilities will ensure the state's firms are globally competitive in the 21st century. Ohio realized that an understanding of its readiness for global e-commerce will help to build the tools for the state to remain competitive. Thus, measuring the state's progress allowed economic development leadership to identify gaps and provide substantial analysis to bolster continued public and private sector support for investment in the information infrastructure required to enable participation by all of Ohio's citizens in global e-commerce.

Ohio is the first state to take on the challenge of developing the methodology and the analytic tools to assess its readiness for global e-commerce. As such, the methodology, process, and tools developed through the effort provide a model for other states to use in measuring their readiness to move into the new economy of the 21st century.

The project described in this report had three concrete outcomes. First, the data generated by the assessment filled a void about Ohio's information infrastructure and its use throughout the state. Second, a centrally developed assessment enabled each region of the state to compare its strengths and weaknesses and set an agenda for future action. Third, the regional and statewide initiative has achieved concrete results. It has laid the groundwork for (1) continued private and public sector investment in information infrastructure; (2) legislation to boost business and consumer usage of the network for learning, social interaction, research,

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[1] *PricewaterhouseCoopers provided partial funding as a collaborative partner in the ECom-Ohio project.*
[2] *The Ohio Supercomputer Center (OSC) is a statewide, shared academic resource that provides high-performance computing and networking capabilities to Ohio's academic institutions and researchers. OSC established the Technology Policy Group in 1995 to provide insights and policy advice on issues related to electronic commerce and information policy.*

and outreach to new markets; and (3) support for a major statewide initiative to put state government services online. This report should serve as a guide to other states and regions that wish to undertake a similar assessment.

Projects to measure a region's readiness for global e-commerce help to promote added investments in information infrastructure, position the debate over the digital divide, spur new business innovation, and provide valuable information to state and private sector leadership developing agendas to advance a region's information technology strategy. In Ohio, numerous state and local initiatives have been developed and implemented, and the state has reaped the benefits of a higher profile for e-commerce applications, increased business usage, and a competitive workforce.

Introduction

The Technology Policy Group at Ohio Supercomputer Center is collecting data on the digital economy in a systematic way, and analyzing the new indicators that would signal a state's or region's relative progress in developing its digital economy. This research study leverages TPG's work in measuring the state's readiness for global e-commerce by describing for a larger national audience the conception, implementation, and application of a set of methodological tools to measure the state's digital economy. The tools being implemented through this effort, called ECom-Ohio, are designed to implement a set of national benchmarks developed by the Computer Systems Policy Project.[3]

To measure Ohio's readiness for global e-commerce, a number of assessment tools available on the Internet and through conventional economic development literature were reviewed. While there are a number of well-established tools by which regional economies measure their performance in manufacturing and service industries, there are few such tools available to measure the newly emerging digital economy. Most tools relevant to the digital economy are designed for application to broad, national measures of performance.

Robust methodological tools showing representative snapshots and trends as indicators of a region's digital economy have not been fully developed. In fact, as discussed at the recent U.S. Department of Commerce conference "Understanding the Digital Economy,"[4] fledgling efforts to date have focused on defining the types of data that should be collected, monitored, and analyzed. While today, comprehensive federal and state government statistical efforts help us to understand the traditional industrial economy with a rich array of databases, the federal government and most state governments are decades away from collecting the types of transaction, usage, and penetration statistics required to understand the emerging digital economy.

The first part of this report outlines the categories of measurement, and the 19 underlying indicators used to assess six different aspects of a region's readiness for global e-commerce. The second section outlines how information was gathered to obtain the indicators used to assess a region's readiness for global e-commerce. The third section focuses on the methodology in more detail, introducing specific measures that were used to judge the readiness of Ohio for e-commerce. This is followed by a section that provides specific examples of the measures for Ohio and its regional components. The final section defines the lessons learned from Ohio's experience and provides keys to success in implementing such a project.

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[3] *The Computer Systems Policy Project is a national CEO group organized to advocate for innovative information technology policy. In July 1998, CSPP published a tool called "Ready, Set, Go: A CSPP Guide to Global Electronic Commerce." (http://www.cspp.org)*

[4] *"Understanding the Digital Economy: Data, Tools and Research," May 25-26, 2000, Washington D.C. Sponsored by the USG Working Group on Electronic Commerce, the National Economic Council, the Office of Science and Technology Policy, the U.S. Department of Commerce and the National Science Foundation. See http://www.ecommerce.gov/*

The ECom-Ohio methodology and model was designed to help regional areas develop the tools and technology to evaluate strengths and weaknesses in their network infrastructure and capabilities of their core business bases in three ways.

First, it provides an easy-to-understand framework through which to analyze a number of different factors together to gauge a region's readiness for global electronic commerce. The ease with which an external audience can understand the framework helps to build external support for infrastructure and program changes required to improve a region's competitiveness.

Second, the benchmarks themselves provide a good comparable view of a region's capabilities. A region may have strong infrastructure measures, but weaker performance on usage indicators. This assures that program initiatives developed to improve a region's capabilities are focused on the right problems.

Third, the assessment provides critical ongoing support for measuring a community's or region's progress as they build the infrastructure capacity and online skills to become a competitive region in the new information economy over a period of time. This allows policymakers to understand where changes in the external market are forcing major changes locally, and to determine what policy changes are required to remove barriers to progress and assure long-term regional competitiveness.

About ECom-Ohio

ECom-Ohio involved over 250 businesses, as well as government agencies, educational groups and technology organizations. It was organized around a statewide steering committee made up of leaders in state government, education, and a number of private sector partners.[5] Project work is completed by TPG in partnership with several university research groups and private sector partners.[6] Discussion of the approach and results was undertaken at both the state and regional levels. In each of six regions, a regional project convenor brought together local business leaders to evaluate the status of their region and to consider recommendations for action agendas.[7] In all, over 250 business leaders were involved in various aspects of the project.

The project focused on four concrete outcomes:

(1) identify gaps in infrastructure and utilization of the technology

(2) develop action agendas aimed at improvements in Ohio's digital economy

(3) analyze regional strengths and weaknesses, and

(4) gauge progress in meeting e-commerce readiness goals.

Action agendas to boost business usage, extend infrastructure to underserved areas of the state, and move state and local governments online were developed at the regional and state levels. The Ohio example provides lessons to groups addressing these questions in their own regions.

Measurement Indicators of Regional Readiness for Global E-Commerce

Assessing a region's readiness for global electronic commerce is far more complex than merely measuring the number of computers owned per household or the number of businesses with websites. The significance of the Internet in building a networked economy is little understood but highly significant in economic terms.

Popular literature uses "Metcalfe's Law" to describe the phenomenon by which the value of a network grows by the square of the size of the network.[8] The power of information technology applications linking manufacturers, suppliers, and producers in a region adds exponential value to a region's economy. Many manufacturing and distribution firms have experienced significant productivity improvements as a result of simple automation. Metcalfe's Law provides a significantly higher value proposition for economic development. Simple automation creates a loosely aggregated set of mechanized transactions within an enterprise, a laudable goal for many technology assistance programs. But a networked economy delivers vastly more value to its

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[8] *An interesting article discussing Metcalfe's law which attempts to quantify its impact on community building and social capital is by Dr. Daniel P. Reed entitled "That Sneaky Exponential — Beyond Metcalfe's Law to the Power of Community Building," Context Magazine, March 1999. See http://www.contextmag.com/setFrameRedirect.asp?src=/archives/199903/DigitalStrategyReedsLaw.asp*

> **Definition**
>
> "Global electronic commerce" is a term used to describe commercial transactions and non-commercial activities facilitated through the use of information technology and network technologies, such as the Internet, intranets, and extranets.

participants by powerfully linking enterprises, individuals, and institutions together through intranets, extranets, and the Internet. Some automakers have estimated that they will be able to reduce transit times by 40 percent, and finished inventories by one-third through implementation of logistics optimization powered by e-commerce applications.

As a networked world becomes a reality in some regional economies — where everyone is connected to everything, all the time — new measures must be developed to assess the level of "connectedness" of an economic system. Because of the very breadth and pervasiveness of electronic commerce, the analysis of the network economy in a region is a critical tool for evaluating the robustness and resilience of a region's "new economy." In developing their "Guide to Global Electronic Commerce Readiness," the Computer Systems

Table 1: Evaluation Components

Network Infrastructure	**Citizens Online**
• Available local backbone	• Internet access at home and at work
• Ability to meet demand	• Schools
	• Libraries
Access to Critical Services	
• Range of services	**Government Online**
• Affordability	• Government websites
• Quality of service	• Employees online
• Competition	
	Community Planning
Business Online	• Regulatory and legislative aspects
• Number of domains	• Interaction between public and private sector
• Websites	• Employment opportunities and skills
• Networking	
• Workforce training and availability issues	
• Business-to-business transactions	

Policy Project (CSPP) took such a broad-based approach. This approach is useful because it allows one to analyze the emergence of a network economy based upon a systemic approach. In doing so, the tool itself educates business, government, and education leadership on the impact of complex new communications and software technologies.

Based upon the CSPP measurement indicators, an assessment of six major categories must be evaluated to understand a state's readiness for global electronic commerce: infrastructure capabilities, access to critical services, business online, citizens online, government online and plans for community growth.[9] Each category is made up of several indicators that give an overall assessment of a region's performance, as shown in Table 1.

The next section describes each of these component indicators and their importance in assessing a region's readiness for global electronic commerce.

Network Infrastructure

1. Available local backbone
This set of measures focuses on the extent to which infrastructure for telephone, cable, broadcast, and

wireless services are deployed within a region. In order to gauge the level of local service provider service and capabilities, it also evaluates whether those networks are owned and operated by multinational providers. To determine the pervasiveness of high-speed networks, the extent to which high-speed access to the Internet backbone is available to users — whether institutional or residential — is also reviewed. Finally, some quantitative measures are developed that measure the actual speeds supported by backbone links between nodes within the region. In the most advanced stage, wireless access to the Internet is also measured.

Map and Codes for Ohio Regions

NE
Northeast Ohio, including Cleveland, Akron, Canton, and Youngstown metropolitan areas

NW
Northwest Ohio, including Toledo metropolitan area

C
Central Ohio, including Columbus metropolitan area

W
Western Ohio, including Dayton metropolitan area

SE
Southeast Ohio, including Athens and rural Appalachia

SW
Southwest Ohio, including Cincinnati metropolitan area

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[9] "Ready, Set, Go: A CSPP Guide to Global Electronic Commerce." (http://www.cspp.org)

Four Stages of Readiness for Global Electronic Commerce[*]

Each region of Ohio, as well as the state as a whole, was categorized in one of the four stages of readiness for each evaluation category. Figures 1-6 present the stages of each region for each category.

Stage 1:

Some communities do not yet have the complete technological infrastructure or access to technologies that enable widespread global electronic commerce.

With good planning and community-wide collaboration, these communities can create an environment that not only supports, but also encourages, the growth of global electronic commerce.

Stage 2:

The community's infrastructure is sufficient to support dial-up Internet access throughout the community.

Businesses and government use networked computers to improve internal operations, and in some sectors, use the Internet for basic communications with customers.

Public decision-makers recognize that computer technology and related skills are important elements of modern education and job training, and are taking steps to make the equipment and skills available to the community.

Stage 3:

The infrastructure is sufficient to support high-speed data services for some sectors. Services are affordable and of good quality.

Business and government have incorporated networked computers into their ongoing activities and, for some entities, electronic transactions are financially significant.

Most residents have access to a computer and to the Internet, whether at home, at work, at school, or in the public library.

Increasingly, basic services and community information are available on the Internet.

Stage 4:

The infrastructure is sufficient to support high-speed, affordable, and excellent quality data services to most of the community. Users have a choice of service providers and of types of service.

Computer technology and Internet access is widely available and integrated into virtually all businesses, schools, and government activities.

Electronic transactions are a substantial revenue stream for most businesses.

In public and private sectors, computer technology and the Internet are used to expand access to information, increase the customer base, and shape new business and employment opportunities.

The community has an ongoing private-public planning process to ensure that residents benefit from the growth of electronic commerce.

[*] *Source: CSPP Guide to Global Electronic Commerce (www.cspp.org)*

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2. Ability to meet demand
This indicator measures the extent to which a region's network is sufficient to support average levels of data traffic accessing it through dial-up modems. It measures the number of connections that fail, ring busy, or are interrupted. For those providers who use quality of service measures, benchmarks for levels of packet loss are provided for each stage of readiness. Additionally, network capacity was tested at different times of day for different size files, in order to mimic simple e-mail traffic as well as more complex distance-learning multimedia applications over the network. Implicitly, these tests assess both the quality of the underlying telephone infrastructure as well as the capacity of Internet service providers.

Figure 1: Infrastructure Capabilities

Access to Critical Services

1. Range of services

Internet services available to large businesses and those available to small businesses or residential users often differ markedly. For this reason, different scales were developed for both types of users. In general, the breadth and capabilities of transmission services and related facilities made available to residents and businesses from local or national providers were tested in a number of ways. In addition, concrete line speeds and technology choices that are available to users (for example, satellite, wireless, cable or xDSL, frame relay, and fractional high bandwidth) were assessed. Lastly, work performed to support this indicator determined whether mobile service options for accessing the web had been introduced in the region.

2. Affordability

Similarly, affordability is an issue for which the scale for small businesses or residential users will be significantly different. For this reason, the indicator differentiates between the two types of users. The study assessed the relative costs of local access numbers, transmission, and service costs for dial-up switched service, ISDN, installation costs for second lines, and service packages. At the most advanced stages, this indicator assumes that pricing for broadband connectivity will eventually be based upon actual usage, although that was not found to occur in Ohio at this time.

3. Quality of service

In this category, quality of service issues are assessed, such as waiting time for redress of service problems and service disruption. Also, the period of time required to start up new service was measured to determine whether hook-up could occur in a commercially reasonable length of time. Lastly, the level of Internet performance in the community was measured, based upon the average download speed and node-to-node transmission time in comparison to national averages.

Figure 2: Access to Critical Services
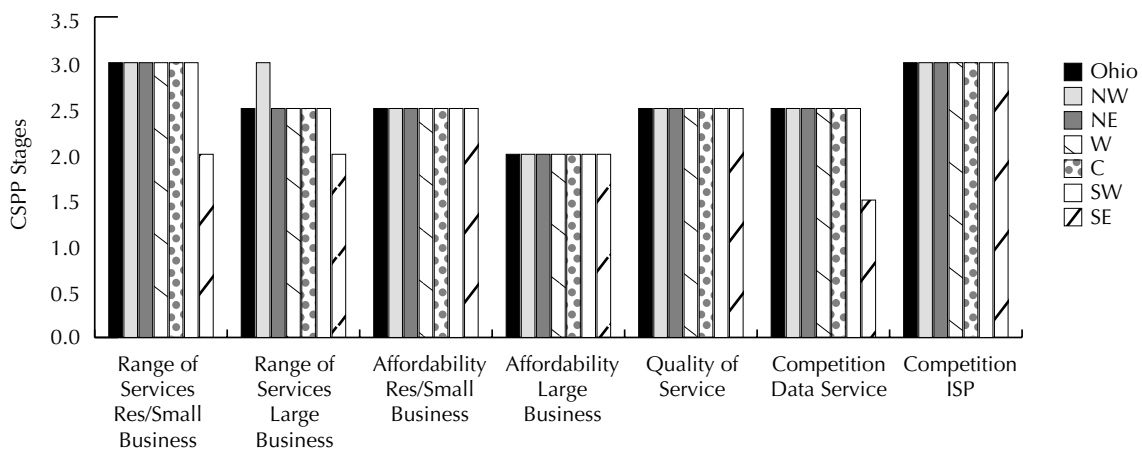
4. Competition

This indicator focuses on the level of competition in two different areas: data services and Internet service providers (ISPs). For data services, the indicator measures the extent to which alternative technologies for access are available and the extent to which they are available from providers other than the incumbent telecommunications provider. For ISPs, the number and variety of service, content, and pricing packages provided in the region were evaluated. At the most advanced stages, this indicator assumes that most customers will be able to tailor services to meet different demands for speed, service, security quality, and cost, although this was not found in Ohio at the present time.

Business Online

The nature, depth, and sophistication of business usage of the network and its services were measured through an analysis of five basic areas: domains, websites, use of networking, business-to-business transactions, and workforce training and availability issues.

1. Domains

Here, the number, prevalence, and growth rate of domains per capita were assessed to demonstrate the level and intensity of entrepreneurial Internet activity in the region. A number of analysts have

looked to domains per enterprise as an indicator of Internet entrepreneurial activity. In calculating both these ratios, the results were similar.

2. Websites

Websites operated by Ohio businesses were evaluated to determine how well Ohio businesses use the network for market development, new market identification and penetration, and enhanced services to existing customers, as well as for automating supply chain operations. In the evaluation, the team analyzed the basic usability of the business websites, richness of content, and functionality in a five-part evaluation. In addition, data collected in users' surveys showed the extent to which businesses are online and the purpose for which they are using the Internet: procurement, inventory management, sales, or research.

3. Networking

Business use of networking demonstrates the extent to which businesses and their employees rely on networked computers in the workplace and that key business functions are networked together to boost productivity. Additionally, businesses that are able to effectively employ network technologies develop innovative and efficient ways of managing their external relationships and communications. This sophisticated network usage helps form the

Figure 3: Business Online
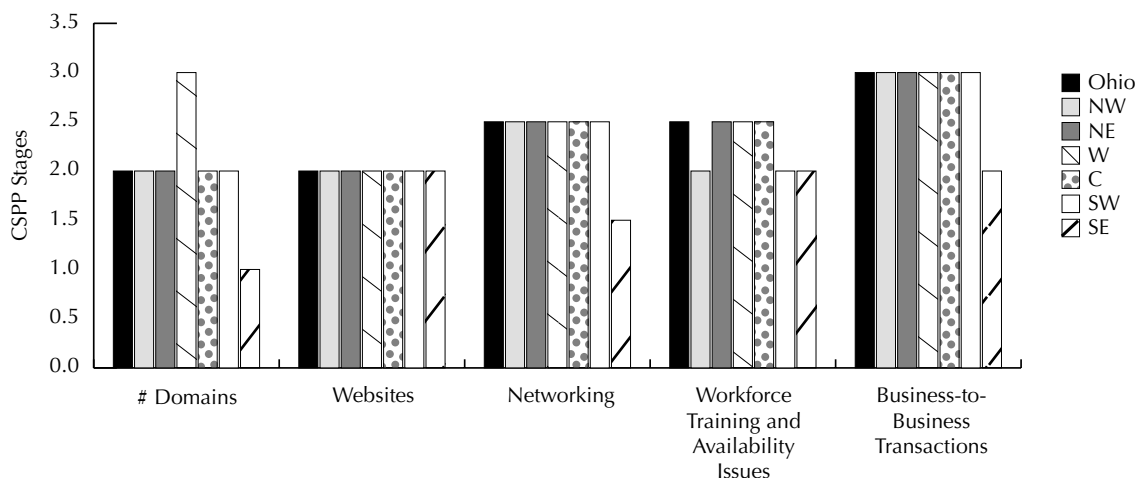
critical mass of electronic transactions, that supports a networked economy, both in terms of network size and its demand for goods and services.

4. Business-to-business transactions

While early analysis and media attention has focused on the business-to-consumer end of e-commerce, the business-to-business realm of e-commerce has the potential to transform conventional business models and distribution channels. The extent to which businesses uses the network to purchase supplies or transact business with its business customers was measured as part of this study. As more and more businesses move to the Internet for supplier functions or selling, this indicator will have a direct impact on the vitality of the regional economy. When businesses move their dealings with other businesses online, they can often communicate more easily, lower inventory costs, and explore new business models more easily.

5. Workforce training and availability issues

Workforce training is a critical constraint to the growth and success of new network businesses. Thus, the level of workforce training that is available on the network and the number of qualified information technology (IT) workers in the workforce to fill demands of companies are critical capabilities to measure. In this area of assessment, the number and quality of technical schools with specialized curricula in information and communication technologies and computer science was evaluated. A variety of training opportunities should exist in the community through vendor certification programs, employers, educational institutions, private training centers, and distance learning courses. Additionally, online resources and courses should be widely available for the development of technical skills "on the job."

Citizens Online

A critical area for the emergence of a pervasive networked economy is the extent to which the community at large has incorporated information and communication technologies into the fabric of its activities in order to maximize the benefits of participation in a networked world. To determine how the community is using information technol-

ogy, it is important to assess not only how many members of the community have access to the technologies, but also how they are using them. This series of indicators assesses citizens' use of online services.

1. Internet access at home and at work

The availability of regular computer access for citizens at home, work, or school was measured. The survey instrument focused on the number of households with Internet access at home or at work, or that have access to the Internet at public access points, and the activities pursued at those sites. It also showed the number of adults online that engage daily or weekly in multiple online activities. As more people access the network regularly, and networks of users grow, there is greater demand and opportunity for network interaction, as well as better participation in networked activities, such as Internet voting, civic participation, product research, and newsrooms.

2. Internet utilization at schools

This indicator measures the number of schools that are wired to the Internet, as well as the number of connected classrooms. Deploying this technology in the classroom has the added benefit of exposing future workforce entrants to network technologies for learning, as well as entertainment, at the earliest ages. Effective utilization of the network at schools also requires training programs for teachers, as well as updated hardware or computing facilities for educational use and smooth integration of network technologies into the educational curriculum.

Figure 4: Citizens Online
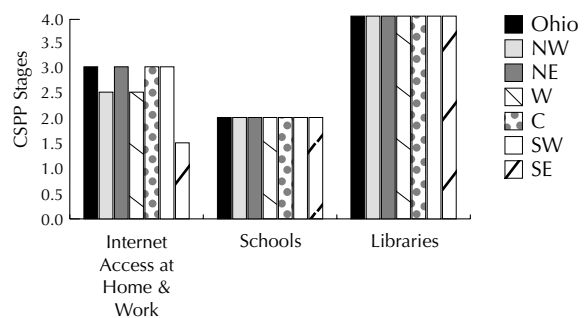
3. Libraries

Libraries are an important public access point for personal research and training, as well as business and job-related research. The indicator used here focused on the use of the network for online services, such as book renewal, catalog inquiries, and research tools, and to facilitate interlibrary loans. Public libraries can use technology and the Internet systematically to expand information resources available to users and to operate more efficiently. State governments are increasingly looking to connected libraries as a system of public access points for citizen services.

Government Online

The extent to which government agencies have websites and use them to provide services, as well as to promote civic involvement, can be a strong driver of network usage among citizens and households. Governments can take advantage of information and communication technologies to improve connections with their constituents.

1. Government websites

This measure assesses government websites using the same framework as was employed in evaluating business websites — namely, levels of functionality, richness of content, and interactivity. The role of government as a leader in e-procurement and e-business transactions when interacting with businesses and citizens can help to draw more people and enterprises into the networked economy.

Figure 5: Government Online

2. Employees online

This measure assesses the level of connectivity of government offices and service workers, and the extent to which workers can perform tasks and correspond with citizens over the network. For e-commerce to become a pervasive method by which government provides extensive, cost-effective services to its citizens, all employees must be online, with access to the network.

Community Planning

A favorable climate created by public policy for Internet use and e-commerce will help to extend network usage and universal penetration in a region. Innovative public policy in these arenas can spur individuals, organizations, and industries to adopt and leverage investments in communication and infrastructure to participate effectively in the networked economy.

1. Regulatory and legislative aspects

Regulatory issues related to build-out of the infrastructure, and competition in data services, are critical to the advancement of a strong regional information technology agenda. This indicator focuses on key legislative and regulatory aspects that are important factors in enabling the network economy, such as telecommunications deregulation, incentives for broadband penetration to under-served areas, aggregation of government and education demand, privacy, PKI, digital authentication, and regulatory reform.

2. Interaction between public and private sector

As communities begin to grapple with the issues inherent in transforming their economic and civic life for the digital age, robust interaction between the public and private sector will be critical to the success of their efforts to build a future. For example, government needs to work with industry to promote a competitive environment for advanced services and high-speed infrastructure. In addition, public and private sector cooperation will be required to devise solutions for the problems of under-served rural and inner-city areas. An ongoing technology planning process will help both private and public sectors ensure that there will be ade-

quate infrastructure to support competitive industries as they increasingly move to online, networked applications.
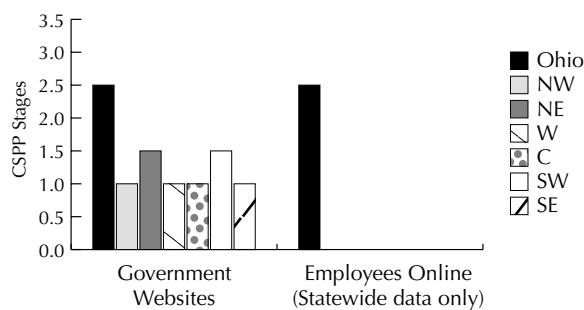
3. Employment opportunities and skills

This indicator measures the extent to which labor market exchange functions are fulfilled on the network, such as job searches, résumé postings and correspondence. Regional economies that have a strong network-based labor market exchange function, where job opportunities are posted online, and résumés can be posted and exchanged easily, are tapping into an international labor pool of potential, qualified workforce entrants. Likewise, they are providing opportunities for local talent to advertise their qualifications and technical expertise to a global marketplace, attracting new investment capital to support and expand pockets of specialized knowledge and technology.

Figure 6: Plans for Community Growth
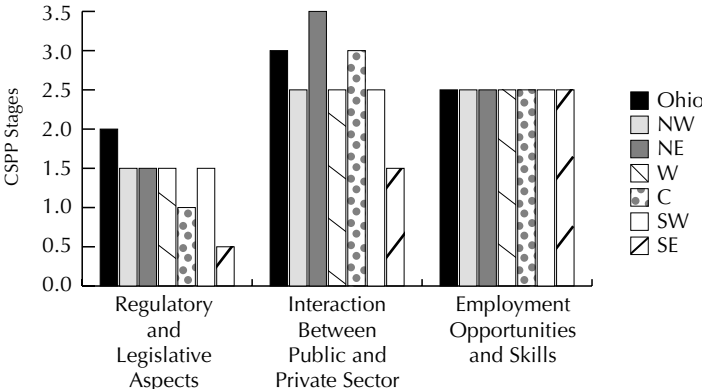
Methodology and Approach

This section of the study outlines the measurement tools used to collect and analyze assessment data evidencing the state's readiness for global electronic commerce for each indicator. Six tools were developed to gather and evaluate the source data for each component indicator of the assessment. Often, information for two or three different indicators in a variety of assessment categories was gathered with each analysis tool.

Table 2 on page 16 shows the major assessment categories and the measurement tools that were used to evaluate their status in Ohio. The assessment required a variety of approaches: (1) evaluations of the physical infrastructure, (2) surveys of the relevant Internet service user groups, and (3) evaluations of service delivery or online information. The remainder of this section describes those methods of evaluation and the tools developed to collect this data in more detail. In each case the tool indicated in Table 2 is described, followed by a summary of the results of its application and an indication of the analytical challenges faced in undertaking that analysis. Readers should be able to use this section to design their own method of assessing their community's readiness for global electronic commerce.

Network Infrastructure Evaluation

1. Methodology
A network infrastructure evaluation analysis assessed the breadth, capacity, and availability of the public data network in the region. The analysis determined how many high-speed data links exist between Ohio's major cities and external links to the Internet. It also measured the capacity of those links between cities in Ohio and major Internet points of presence (POPs). Lastly, it inventoried the type and availability of high-speed data service from major network providers serving Ohio.

A two-step process was used to assemble ECom-Ohio's findings in this area. First, network providers were interviewed to assess the breadth and capacity of their networks operated in each of the six regions of the state. Providers with statewide coverage were asked to complete multiple questionnaires to obtain data for each of the six regions. Both regulated and unregulated network providers were assessed, as well as cable data network providers. Second, a network map was created from aggregate data publicly available through network providers themselves and through filings at the Public Utilities Commission of Ohio (PUCO).

2. Results of Analysis
Through this analysis, a comprehensive map of the state's network connectivity was developed. While there are strong levels of connectivity in Ohio's metropolitan areas, there is almost no broadband connectivity in rural areas. Providing quantitative evidence of a geographic "digital divide" is a useful tool in working with state policymakers, legislators and others interested in assuring that the state has the tools and infrastructure to remain competitive.

Table 2. Measurement Tools Used to Evaluate Component Indicators

Category	Component Indicator	Measurement Tool
Network Infrastructure	Available local backbone	• Network Infrastructure Evaluation
	Ability to meet demand	• Network Infrastructure Evaluation • Web Testing
Access to Critical Services	Range of services — residential households	• Household Survey
	Range of services — business	• Business Survey
	Affordability — residential households	• Household Survey
	Affordability — business	• Business Survey
	Quality of service	• Web Testing
	Competition — data services	• Network Infrastructure Evaluation • Web Testing
	Competition — Internet service providers	• Web Testing
Business Online	Number of domains	• Domain Analysis
	Websites	• Website Analysis
	Networking	• Business Users' Survey
	Workforce training and availability issues	• Business Users' Survey • Website Analysis
	Business-to-business transactions	• Business Users' Survey • Website Analysis
Citizens Online	Internet access at home and at work	• Household Users' Surveys
	Schools	• Statewide School Survey
	Libraries	• Statewide Library Survey
Government Online	Government websites	• Community Scan
	Employees online	• Community Scan
Community Planning	Regulatory and legislative issues	• Community Scan
	Interaction between public and private sector	• Community Scan
	Employment opportunities and skills	• Community Scan

3. Challenges to Analysis

There are a number of problems in developing an authoritative network map of connectivity in a geographic region. First, the data being collected through this tool is deemed proprietary and sensitive data to a number of network providers in the state. To gain the cooperation of private sector partners, the data must be aggregated in such a way as not to disclose proprietary information. Second, a network map was developed from data that is readily available for some metropolitan areas, but less well-documented, if at all, for rural areas of the state. Exceptional cooperation is required from network providers to complete the analysis accurately. Lastly, given the complexity of leasing, peering, and rental arrangements between network providers, obtaining an accurate picture of the network is difficult without extensive consultation with numerous authorities. While a start could be made on developing such an infrastructure inventory for the state in the first year of analysis, an ongoing data collection and analysis operation will be required because the data is fragmented and changes at such a fast rate.

Users' Surveys (Household, Business, Schools)

1. Methodology

Three surveys were developed to assess Ohio household, business, and school usage of the Internet. These surveys covered a broad range of issues, such as costs, choices available, pricing, purchase behavior, and availability of services over the network. The ultimate goal was to develop an understanding of the rate at which technology is adopted among regional markets throughout the state.

Data was collected through extensive telephone surveys to a random sample of households, businesses, and schools. The samples were balanced demographically and were numerous enough to provide reliable responses in each sub-region of the state. This allowed the teams to evaluate gaps between regions of the state, and differences between demographic groups and different size businesses. For households, the survey was designed to provide insights into the current state of Internet familiarity and level of technology knowledge. For businesses, the survey was designed to

provide insights into their current level of preparedness to enter e-commerce, their business practices, an inventory of technological equipment, and their level of willingness to participate in e-commerce activities. For schools, the level of connectivity and usage of the Internet was reviewed.

2. Results of Analysis

The analysis team was able to collect user survey data that went well beyond the exact indicators called for in the CSPP guide, providing the team and collaborative partners insights into key barriers to pervasive acceptance and use of network technologies. For example, our household survey revealed that over 45 percent of Ohio households cite privacy and security concerns as a primary barrier to purchasing goods and services online. For businesses, the survey team was able to determine the acceptance level for electronic contracts and digital signatures, which was quite high.

For the business survey, 2,832 interviews were completed, with about 18 percent of those being "reluctant" responders who did not complete the survey. For the household survey, 2,506 interviews were completed. Core question capture was used for comparison, revealing that based on attitude bias, our responses gave a 3 to 5 percent overestimate of usage.

3. Challenges to Analysis

The primary challenge in generalizing from the business users' survey was the real differences revealed between large and small business users. The sample we selected was not stratified for employee size, and there are enormous differences between usage of websites for marketing and communication with customers as companies exceed 100 employees. Second, attitudes towards computers and technology had a tendency to self-select responses from "full" responders, "cooperative" responders, and "reluctant" responders. Reluctant responders comprised 18 percent of total surveys; they were from smaller businesses and were far less likely to use technology of any type. The sample selected also was not large enough to support robust results when segmented by industry sector. However, we were able to verify the rate at which businesses use websites by comparing the results from the surveys to the website analysis conducted

using Web search tools. There was less than one percent difference between the rate at which businesses surveyed had websites, as determined through the users' survey, and through the website analysis (see below).

For the household surveys, the primary challenge was in the differences revealed in analysis of demographics — the "digital divide." However, with information collected on age, gender, and household income of the respondents, we found Ohio's data paralleled national findings — older, poorer, and less educated citizens have lower usage rates. Another challenge identified was the difficulty with which we could identify true SOHOs, or "small office-home office" businesses operating out of residences. Anecdotally, broad-band network providers on the statewide steering committee indicated that these users accounted for a significant amount of bandwidth demand in residential neighborhoods. The survey tool must be designed to take these alternative uses of network infrastructure into account.

Web Testing

1. Methodology
This testing tool assessed the quality of Internet services available in each region of the state, including an assessment of the number and quality of Internet service providers in each area as well as an inventory of high bandwidth services available.

A user interface and a set of control programs were developed to run on an Intel computer with the Linux operating system. The interface allows the user to create a database of ISP dial-in accounts including the dial-in telephone number, username, and password. The user can then initiate a testing sequence. The computer is connected to a dedicated telephone line and once testing is initiated, dials each account in turn and runs a series of tests. Results are saved in a local database. Tests are repeated continuously for a period of at least two weeks in each location. At least one location was tested in each area code of the state.

The test suite assesses the quality of the ISP service in several ways:

- Busy signals — calls that result in busy signals are reported. This information demonstrates the number of times and times of day when the service is difficult to reach.

- Ping tests — these data logged response times to pings to a set of standard sites are conducted to ascertain the timing of the response. Higher response times imply slower service to the end user.

- Transfer tests — using several protocols (http, FTP), the transfer time to download files of known sizes was tested. This simulates the types of Internet activities an end-user would be conducting and will allow a quantitative comparison of ISP performance. The actual measure indicates whether the routing infrastructure of the ISP (and its upstream feeds/peers) is sufficient to handle the total volume of traffic.

- Mail tests — mail is sent from the host system to a receiving account. The time to receipt assesses the capacity of the mail function on the ISP server.

- Cross-tabulation of performance measures — there were some relationships among the test results, for example, between trace route distance and transfer performance. These were tested using standard statistical analysis tools.

2. Results of Analysis
The analysis showed that there is tremendous variation in dial-up speeds obtained throughout the state. There does not appear to be an easy explanation for these variances: dial-up service in some of the highest usage areas of the state was at half the speeds achieved in other, low usage, rural areas. Testing at more than one location in each region in future work should help to define whether these differences were a reflection of real regional differences in the infrastructure or problems associated with one particular telephone office.

Performance of different ISPs over time and by size of file being transferred was compared. No consistent degradation of performance at the peak usage times for Internet traffic was detected. This demonstrated that Ohio's usage of the network does not outpace its capacity as of yet.

3. Challenges to Analysis

The primary challenge to our analysis was the sampling strategy because of the fragmentary and inaccurate nature of current listings of Internet providers. Nationally marketed ISP Guides were subject to error, with a substantial portion of their listings out of business or without local service where indicated. A second factor impacting the sampling strategy was the total pool of network providers. In some areas of the state, we sampled a full 100 percent of ISPs in the area, since there were often less than five servicing an area. Finally, network providers that use proprietary connection software that was not compatible with a Linux dial-up dialogue could not be tested using this software tool.

Another challenge was the sheer volume of data generated from the testing units, as well as storage and retrieval of the data. While our testing protocol allowed us to review traceroute information, the volume of data generated was too complex to transmit reliably over the network. We used zip disks to store the data and mailed them back to the regions.

Domain Analysis

1. Methodology and Approach

This tool collected data on the number, prevalence, and growth rate of domains registered in Ohio for its businesses, universities, and networks. The total number of domains by ZIP code, by type of domain (.com, .net, .org, and .edu) was collected from Network Solutions, Inc. (NSI) under a special arrangement. Monthly data provided by NSI allowed us to calculate growth rates in domain registrations from September 1998 through October 1999.

2. Results of Analysis

The results of this analysis showed the density of domains and their geographic distribution throughout the state of Ohio. Additional data on firm and population density in the state allowed the analysis team to make conclusions about the overall prevalence of domains and the level of entrepreneurial activity in each region of the state.

3. Challenges to Analysis

There were several challenges to this analysis. Many enterprises have more than one domain name. Thus, the number of domains per establishment would be overcounted to the extent that multiple web addresses exist. Secondly, the data is proprietary. Only through a special non-disclosure agreement with NSI were we able to obtain this data on a geographic unit basis. Lastly, a domain may exist on a server that is not located in the region; conversely, an enterprise associated with a domain may not be located in the region. On balance, this factor was assumed to result in an overall even split for Ohio companies and was ignored as a variable.

In the future, analysis of this metric will be complicated by the fact that in 1999, ICANN[10] certified a number of new domain registries. With this proliferation, the previous monopoly on domain registrations provided by NSI will be supplemented by numerous other domain registrars. Additional non-disclosure agreements will need to be developed with these registries. Alternatively, there are several websites that also may be upgrading their information to provide this detail to users.

Website Analysis

1. Methodology and Approach

The business website assessment addressed issues raised by the indicators for the Business Online sections of the CSPP grid in terms of market development and market. These sections focus mainly on how many businesses are online and what the businesses are doing on the Internet. In addition to the information pertaining to these sections, data was collected on the basic usability of the business websites, such as:

- Level of products and services information or purchasing is available on site

- Level of customer service offered through site

- Ease of navigation on site (indicated through links on site)

- Indicators of companies' use of customer purchase tracking and segmentation based on customer demographics

- Use of push technology and e-mail to draw customers to site

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[10] ICANN is the Internet Corporation on Assigned Names and Numbers (http://www.icann.com).

A sample was pulled from a listing of all businesses in Ohio. This sample was provided by the same external firm used to provide the sample for the business users' telephone survey. The actual assessment will be developed by going to the URL indicated in the sample and evaluating the website based on a five-point scale measuring the site's functionality, content, and ease of use. The data was gathered by staff at OSC and reviewed by the team leader. The staff completing the data collection were trained on the assessment tool using actual websites as examples. The team leader reviewed the data collection effort to ensure consistency and accuracy of the data.

2. Results of Analysis
The website analysis showed that only 15 percent of businesses currently have a website in Ohio, and only 3 percent are selling products on the web. As expected, we found that larger businesses are more likely to have a website and sell products online. Surprisingly, there was little difference in the percentage of businesses that have a website across all regions. However, there were significant differences in web presence and sales by industry segment.

3. Challenges to Analysis
The challenge to this analysis was similar to that noted in the domain analysis. While a company may have a location in Ohio, its website may be developed and maintained by a corporate headquarters operation elsewhere. In this case, we counted a corporate website as an Ohio facility's website. A second challenge involved the sampling frame. The tremendous number of businesses with under 10 employees had a tendency to depress the website response rates, since businesses of that size are unlikely to have a website or sell from one. Thus, the results were surprisingly low to many observers. Additional sampling will be required to be able to assess the robustness of Ohio's online business community. Lastly, it is important for the business website analysis and the business end users' survey to complement each other to provide a complete analysis. This was accomplished by strong interaction and discussion between the workteams completing both analyses.

Community Scan

1. Methodology and Approach
The community planning portion of the ECom-Ohio analysis provided the team with insights on the kind and quantity of government services being provided to communities over the Internet at the state and local levels. Additionally, the team inventoried key regional technology efforts advancing network infrastructure, electronic commerce, and business and community access. Because of the importance of workforce issues in addressing this growing sector of the regional economy, the team also surveyed ways in which the Internet (especially the World Wide Web) is being used to link employers and job/training seekers in Ohio.

The data was collected through a combination of written requests, telephone interviews, and web research. Information collected included initiative name, background, mission and program, funding efforts, cooperative agreements, and implementation plans. Also, local government websites in all 88 counties were evaluated to determine the range of services available online, including substantial work to review and assess the usability and interactivity of employment and training websites. To assess the level of state services provided over the network to citizens, we evaluated the websites of every state agency, board, and commission using a similar evaluation tool to that used for the business website survey.

2. Results of Analysis
The data collected in this category provided information on the number and prevalence of new communities created, employment opportunities and skills, and the relative effectiveness of community planning efforts in each region. Few local government units outside of metropolitan areas are online. Of those cities online, there are limited government resources, downloadable forms or other self-service options for citizens. The findings of this analysis have spurred state action to develop ways to share costs among local government units for web hosting and other services.

3. Challenges to Analysis
There were several real challenges in this section of the analysis. First, a major problem was encoun-

tered in objectively characterizing the level of maturity or effectiveness of community initiatives. Participants in the review team were critical of the subjective nature of the assessment benchmarks provided by the CSPP tool, and, therefore, this area of analysis was both difficult to complete and provided little added value. For the more quantitative aspects of evaluation, another challenge lay in the fragmentation and overlapping jurisdictions of regional technology organizations at both the local and statewide level. With numerous cooperative efforts sponsored locally by chamber groups, newspapers, government and local businesses such as ISPs, the fluidity and transparency of web applications and their relationships made it difficult to extract government involvement from other private sector efforts. Although an analysis of web-enabled applications for citizens sponsored solely by government entities might be useful, it would significantly understate the richness and complexity of communities and their presence on the Internet. Clearly, a new set of measures should be developed to evaluate the breadth and pervasiveness of network technologies to deliver citizen services, regardless of sponsoring source — government, private sector industry, trade association, or local newspaper.

# How Ohio Used ECom-Ohio To Advance Its IT Strategy

Indicator values and results can be interpreted to evaluate strengths and weaknesses to develop concrete actions to improve the overall readiness of the region for global electronic commerce. To encourage the public to compare and contrast results achieved for the six different components of e-commerce, ECom-Ohio showed where Ohio's performance was leading or lagging.

Figure 7: CSPP Grid Summary — Statewide Urban
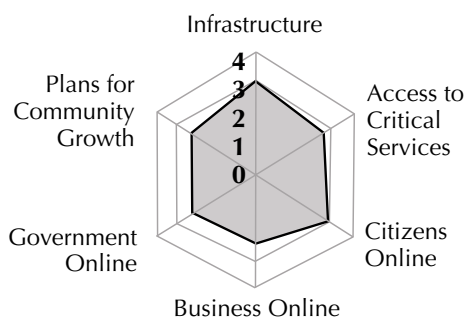
In this graphic, Ohio's readiness scores for metropolitan areas are compared in the six major category areas. By comparing the state's high performance on infrastructure, and its medium performance in terms of business online, ECom-Ohio data showed that the state needs to boost its business usage to maximize its leverage of the infrastructure in place.

Figure 8: CSPP Grid Summary — Statewide Rural
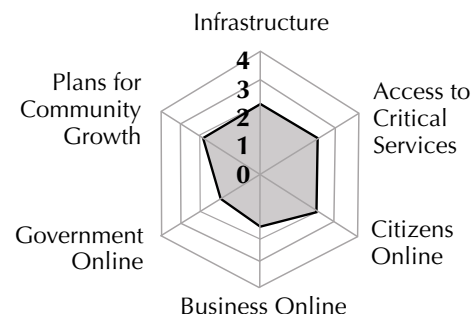
In this chart, Ohio's readiness scores for rural areas are compared in the six major category areas. By comparing the state's low performance on infrastructure in these regions, and its medium performance in terms of business online, ECom-Ohio data showed that there is pent-up demand in rural areas for high bandwidth services; Ohio business and residential consumers are taxing the current limited infrastructure.

Now, we discuss three examples where interpretations of contrasting indicator values achieved in the Ohio analysis have led to concrete changes in leadership perceptions of the overall "readiness" of the state, as well as to actions being taken to offset critical weaknesses and gaps identified through the analysis.

Input for the Debate Over Deregulation and the Telecommunications Infrastructure in Ohio

The Ohio Legislature, like many states, has been enmeshed in a debate fueled by the incumbent telecommunications providers and other alternative network providers over deregulation of the telecommunications industry. As a result of the public debate ranging over the details of various incentive proposals being considered to expand broadband infrastructure, many Ohioans believed that all areas of the state were being shortchanged in terms of investment in network infrastructure.

Figure 9: Statewide Results for Infrastructure Measures
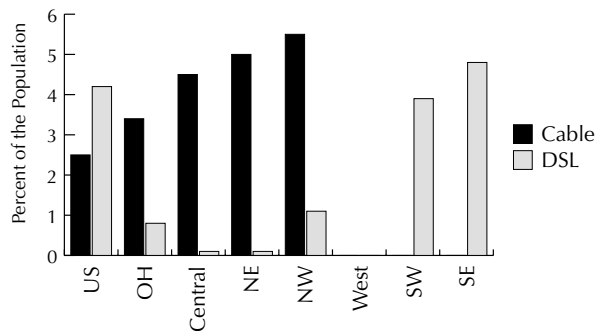
Source: ECom-Ohio, Jupiter Communications
Note: Low number of responses in some Ohio regions may distort results

The first set of indicators reviewed to assess infrastructure measured available local backbone.[11] The data collected showed that infrastructure for telephone, cable, and wireless services are deployed throughout the state, but there are spots in every region that lack broadband service. Additionally, penetration of cable modem use in Ohio exceeds national averages, showing an aggressive cable provider marketplace. DSL service is not broadly deployed throughout the state, although there is substantial usage of DSL service in Cincinnati and Athens, where two providers have invested heavily to deploy DSL. Voice grade wireless access is available in at least 50 percent of the geographic areas of all regions of the state. In most areas, infrastructure supporting speeds of 1.5 Mbps or more is extended to most areas. The results of this analysis

[11] See data reports and grids summarized at the ECom-Ohio website, www.ecom-ohio.org

showed a major differential between urban and rural areas of the state; Southeast Ohio achieved a Stage 2 rating on this indicator, while the remainder of the state achieved a 3.5 rating.

The second group of indicators measured infrastructure capacity — its ability to meet demand requirements of household and business customers. Our testing shows that the infrastructure in urban areas is sufficient to support average levels of data traffic accessing the Internet through dial-up modems today. However, as data traffic continues to increase exponentially, the network may not be robust enough in some areas to support it. In Southeast Ohio, the picture was quite different. Its infrastructure was not yet robust enough to fully guarantee reliable data transmission. Packet loss and transmission disruptions are experienced regularly by some users or in some areas. Thus, Southeast Ohio achieved a Stage 2 rating in terms of this indicator, while the remainder of the state achieved a Stage 3 rating.

The ECom-Ohio data showed that infrastructure was adequate to meet present demands in most large metropolitan areas, with shortfalls evident in smaller communities, like non-urban areas and Southeast Ohio. This has helped to focus the debate on areas where incentives will provide the most payback.

The Interplay of Infrastructure and Usage

In each region, the findings on infrastructure and business usage were compared to determine whether infrastructure limitations were impeding aggressive utilization of the network for commerce or communications. In terms of business usage of network capacity, several indicators were measured. ECom-Ohio survey results revealed that the Internet is a part of many business plans, and there are visible efforts by individual businesses and individuals to advertise online capabilities to potential customers in the community. However, only about 15 percent of businesses overall in Ohio have websites, although that percentage is largely related to size of the business. Once businesses employ more than 100 employees, the use of websites increases to 70 to 80 percent. In most areas of the state, consumers can reach few local businesses online and thus do

Figure 10: All Business Online
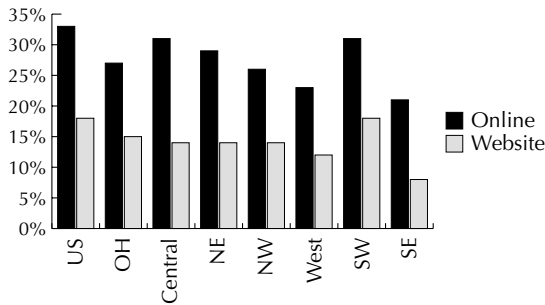
Source: ECom-Ohio, Forrester Research

not shop local businesses for products online. Looking at performance on these indicators, the state overall achieved only a Stage 2 level of readiness. The Southeast Ohio region achieved only a Stage 1.5 in terms of business usage of the Internet.

Comparing the ratings for infrastructure capacity and availability with business usage of the network in Ohio shows that, for urban areas, lack of infrastructure is not a significant barrier to business usage of the network for commerce and communications. Clearly, business usage must be boosted to assure that Ohio's businesses can remain competitive. Aggressive efforts to boost business usage, as described below, may also help to provide the push required to expand infrastructure buildout, particularly to underserved areas of the state.

These conclusions provided direction to a number of regional and statewide entities in formulating policy priorities and long-term strategic direction in telecommunications development for the state of Ohio. The findings informed the Public Utilities Commission of Ohio as it considered policies required to extend infrastructure in the state. It used this guidance to focus attention on the southeast region of the state, where rural Appalachian geography and the competitive situation of the incumbent telecommunications provider in the area inhibited extension of infrastructure to the area. Similarly, Ohio Governor Taft's Technology Action Board is using these findings to inform a major policy initiative focused on expanding broadband deployment throughout the state.

Several state policy initiatives and programs have been undertaken as a result of this finding. For example, state-level economic developers are considering legislation to provide a tax credit or other incentive to businesses that provide discounted purchase programs to their employees for home computers and network access. The state chamber trade association has made e-commerce the cornerstone of a new initiative to boost its members' awareness of the potential of e-commerce to contribute to productivity and profits.

State-funded Small Business Development Centers are using ECom-Ohio data to educate their field staff in providing technical assistance and a "how to" guide for small and startup businesses to get onto the web and use e-commerce tools. Ohio's technology transfer and assistance programs, the Edison Centers, are each investing in training tools and personnel to provide extension assistance to their manufacturing clients in automotive, metal fabrication, manufacturing, and polymers in e-commerce applications relevant to their market. It is hoped that by infusing numerous state economic development and business assistance programs with links to e-commerce usage, a "pervasive" e-commerce environment can be nurtured among Ohio's strong traditional sectors of strength.

The Imperative To Move State and Local Government Online

Often, government can be of assistance in deploying tools and technologies quickly to promote new methods of procurement or service delivery, or provide private sector firms the incentive and encouragement to emulate new practices. The ECom-Ohio findings in this area showed that in e-commerce applications, Ohio's state and local governments trail innovations in the private sector. Ohio's state government websites were reviewed for content, usefulness, interactivity and functionality. A similar survey was performed for community websites, including those operated by chambers, local municipalities, counties, cities, and towns.

The data collected showed that all statewide agencies are online and post key information on their websites, including directories of services, hours of operation, and downloadable forms. While some

Figure 11: All Regions, Government Online

Statewide Websites
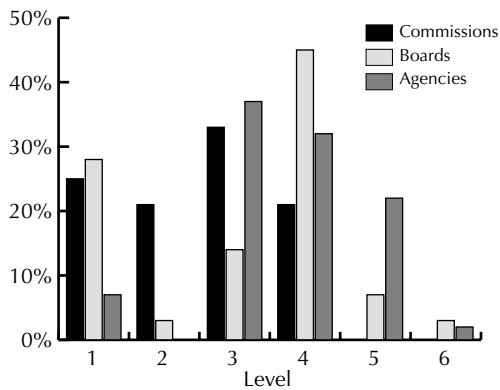
94 sites inventoried: 41 agencies, 29 boards, 24 commissions

Local Government Websites

165 sites inventoried: 96 cities, 32 villages, 27 counties, 10 towns

sites were out of date, others featured interactive forms and were quite sophisticated. However, few local government entities are online. For some counties and communities in Ohio, there is little or no web presence. Few cities, towns, or counties are aggressively using the Internet to furnish public services or information. There are exceptions to this: Sylvania, Ohio[12] (population: 19,274), has implemented a far-reaching plan to put ser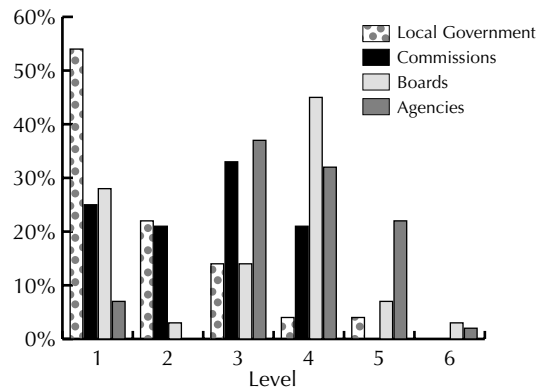vices and citizens online throughout the community. Cincinnati, Ohio, allows its citizens to pay parking tickets online.[13] Ohio's library system is a "bright spot" in the area of citizen access, with public access points to broadband services at every library in the state.

For state government, the data collected showed that Ohio ranked a Stage 2. In terms of network connectivity and public access through Ohio's library system, they scored an impressive Stage 4 rating throughout the state for their level of connectivity and Internet service to the general public. However, overall, the local government scene in Ohio finds entire counties without an Internet presence, or with merely a "placeholder" in cyberspace, with little use of the technology to deliver services or inform citizens.

The data collected through ECom-Ohio and general heightened public awareness has led to a number of statewide and local government initiatives to improve Ohio state and local government use of web-enabled services to better serve its citizens. For example, the state CIO is developing a plan to put all Ohio state agency services online by 2003, which is an aggressive timeline. Additionally, as part of that plan, and in response to the ECom-Ohio findings, the state CIO is initiating an effort to develop a state-funded and operated "portal" for local governments to ease their entry into web-based service delivery. In Toledo, Ohio, the regional leadership team developed a strong plan to boost web-enabled services throughout government agencies in the Northwest Ohio region by working together with the Toledo Metropolitan Council of Governments (TMACOG). A private sector group has pledged to work together with TMACOG to develop cooperative web hosting arrangements to lower the costs of putting services and information onto the network for small cities, townships, and counties in the area.

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[12] *Sylvania, Ohio (www.cityofsylvania.com) has developed a richly functional website and has implemented an aggressive plan to provide broadband connectivity to all its citizens. These initiatives earned the town award-winning status in Yahoo's rankings of community sites online in 1999.*

[13] *See www.rcc.com*

Assessing a State's Readiness for Global Electronic Commerce

Keys to Success

Mounting a major initiative to assess a region's readiness for global electronic commerce requires a strong partnership among key governmental, industry, and educational groups in the area, and a commitment to advancement of a competitiveness agenda regionwide. This is critical because of the interdisciplinary nature of the data being collected and the assessment being made. Strengths in one area are often not perceived by another group, and the exchange of views between different industry sectors is critical to building a strong agenda for action.

There are major implementation challenges to mounting measurement efforts, especially for a large state, in which regional economies may differ significantly in their reliance on, and usage of, the network. Both analytical issues and organizational and institutional barriers can have a major impact on the reliability and application of the study's findings. Below, we outline some keys to success in implementing such an effort.

Success Factor One: Integrity of data collection and robustness of analytical approach will build credibility for the project.

Choose a regional area that produces actionable findings.
The size of the region chosen for analysis is critical to the relevance and usability of its findings.

Collecting data on a statewide basis often masks significant differences revealed in analyzing regional variations in access, usage, or infrastructure. Collecting data in a small geographic region — such as the urban core of a city — can often leave out a substantial portion of the networked economy, especially for ex-urban areas, where growth rates and use of the network may be quite high. Collecting data on a multi-county, regional basis seems to provide the most meaningful analysis, so that the economic substance of transactions within an entire regional trading area can be analyzed.

Deal forthrightly with rural-urban issues.
Rural-urban issues are critical in an analysis of the emerging digital economy. Rural areas often suffer from a paucity of infrastructure assets. The significant differences in infrastructure performance, usage, and access to the network revealed in a systematic analysis of their readiness for global electronic commerce provides strong data for public policymakers to support market-driven incentives to extend the network to less populated areas and foster competition among network providers. Much more difficult to demonstrate are the differences in network capacity and usage within low-income urban core areas, where access to network services may be limited. These zones tend to be combined with very high network usage and access data powered by business users located in metropolitan business areas.

Address critical demographic issues.
Demographic issues must also be addressed in any study of this kind. A clear "digital divide" in terms of usage of network services exists, especially as household education level and income declines. This can be compounded by lower response rates among these groups. A similar gap, less well documented in the literature, exists between firms of different sizes. While firms with more than 100 employees are likely to use both the Internet and have a website, firms with fewer employees typically do not. Regions characterized by large numbers of small businesses will show reduced rates of Internet and website usage. In future ECom-Ohio data collection efforts, a more robust effort will be made to analyze the usage and "take up" rate for new technologies among firm in various industry sectors in which Ohio is strong.

Be aware that proprietary information may impede analysis.
Because the network economy is just emerging, data related to usage, access, and infrastructure are often proprietary. This barrier is a tremendous issue for two particular areas of analysis: domain data per capita, and infrastructure. In the case of domain data, non-disclosure agreements and other arrangements can be put in place to allow for release of the data. For infrastructure data, such as the breadth and capacity of network infrastructure, the issue is more problematic. This data is often difficult to aggregate, especially in regional areas where there are few competing telecommunications or data providers. While customized non-disclosure agreements can make this data available for analytic purposes, the emerging competition between telecommunications and alternative broadband network providers, such as cable, microwave, or wireless, will make acquisition of this data more complex in the future. As network connectivity infrastructure is recognized as an increasingly important evaluation factor in company location and expansion decisions, this issue may gain some prominence, prompting higher levels of public disclosure.

Success Factor Two: A well-conceived and implemented organization strategy will engender cooperation and bridge institutional barriers.

Government-university-industry partnerships are critical to success.
An evaluation of this kind is most successfully conducted using a partnership approach that joins government, university, and industry resources together in a unified strategy. This is critical because of the pervasive impact of electronic commerce and the network economy on many institutions in the region. This type of partnership allows development of a longer-term competitiveness strategy with a broad cross section of participants with the means to effect changes required to improve many aspects of the new network economy. With a single purpose, these enterprises often have the breadth of mission, innovative drive, and capacity to take on complex problems requiring sustained regional attention from a variety of perspectives. A broad partnership also brings with it the credibility to deliver an assessment that is not biased toward any one business, government, or university entity. This, in turn, increases the potential for acceptance and provides a wider set of mechanisms to work toward implementation of common goals.

Industry competition can have a positive impact.
Industry competition can have a positive impact on conducting evaluations of this kind. For example, by bringing together competing telecom and cable providers, we were able to develop a level of confidence that allowed some of them to share data and observations on common problems, as well as build partnering relationships to boost the capability and capacity of the local economy. However, there are clear problems inherent in getting competitors to share information. Initially, great reluctance was expressed in sharing information between potential competitors. But if they are supporting work of a trusted third party for the long-term benefit of all, competitors may be willing to share additional information.

Galvanizing statewide and regional leadership through the process focuses policymakers on critical competitive challenges.

The emergence of the new, networked economy makes its impact felt as old-line industries change, new companies emerge, and the fabric of high-value jobs in an economy shifts from conventional manufacturing and services to new information and knowledge jobs. New tools are required to measure the performance of the infrastructure supporting a networked economy. The collection and analysis of data on the networked economy provide strong input into the policymaking forum for the regional and statewide industry, government, and university leadership to use in designing strategies for the future. For example, the ECom-Ohio initiative will be providing data and input to the legislature as they design new technology legislation and responses to ongoing telecommunications deregulation.

Ohio's state government has used the findings of ECom-Ohio to develop a new "state portal" initiative to offset some of the Web hosting and other support costs for local governments to spur them to move citizen services online. Private industry has used the ECom-Ohio process to encourage more businesses to provide training to their workers and incentive programs to boost household ownership of computers and usage of the Internet. Ohio's Chambers of Commerce are actively using the ECom-Ohio findings to raise awareness of the urgent need for small businesses to master the skills of e-commerce to remain competitive. The information provided by ECom-Ohio has empowered many different groups to undertake actions to improve the competency of Ohio's businesses and citizens in the skills of the new knowledge economy.

Success Factor Three: Strong project management will ensure high-quality results.

Stakeholder interests must be balanced to spur concerted action.

It is critical that a partnership initiative develops a way to effectively balance stakeholder interests. Often, this will be inhibited because some stakeholders are more expert and organized at participating in and deriving advantage from these initiatives. Others may be "new upstarts." For example, the incumbent telecommunications carrier may have participated for many years in the region's long-term technology agenda-setting; the cable telecommunications industry may have been involved much more in local government franchise negotiations and have little experience, documentation, or expertise in dealing with statewide legislative or regulatory issues. In the newly competitive landscape for local telecommunications and Internet access services, the presence of other prominent industries, such as manufacturing or financial services, helps to focus all participants on a positive agenda that enhances the competitiveness of all industry groups. It is critical that any partnership initiative to boost a technology agenda effectively balances the needs of all involved stakeholders.

Without this balance, any study of electronic commerce runs the risk of being perceived as self-serving, pushed by one or a few narrow interests. With a broad stakeholder base, the results can more easily be accepted as representing all of the community interests and of being "vendor neutral." This will allow both the state and regional/local communities to focus more objectively on the problems and opportunities revealed by the study and less on individual agendas.

Strong CEO leadership is critical to project success.

A second critical element is strong CEO leadership. The steering committee or panel guiding the effort must be led by a strong leadership group with a vision for the future and an orientation towards action. While data are critical, more critical is the need to establish strong leadership and a process by which the participants have the confidence and the ability to plunge in, make recommendations, and take concrete action. The presence of a strong CEO leadership group is also critical to setting the stage for a discussion that focuses on the broad public policy benefits of a long-term strategy to boost the readiness of a region for global electronic commerce, rather than a self-interested corporate or interest group agenda.

This implies that study organizers focus initial efforts on gaining the commitments of the CEOs of

the participating governing group not only to contribute funds for the study but also to participate actively in meetings and planning sessions. Although one cannot expect to have busy CEOs at every meeting, there needs to be reasonably consistent participation by those individuals. Substitute attendees will not provide the same impetus to the study results nor can they take action without consultation with the CEOs they represent. Such consultations will hamper the project by markedly slowing project progress.

Flexibility in the study approach should be maintained to allow a shift of focus to those issues most important to a region's status.
It is critical to take a flexible approach to the initiative — members of the steering committee may wish to investigate a particular aspect of a region's network infrastructure usage by a particular demographic group or other issues. A flexible approach allows the group to shift gears and focus on ways in which the initiative is of most use to the entire group. For example, a flexible approach may allow the group to focus on a particular economic need or gap evidenced through the findings for long-term, sustained work and development.

Although the tools developed provide a relatively consistent dataset across regions, each region may interpret the data differently based on their experience in the local, regional, and national economy. Their understanding of the local business climate, demography of the region, and linkages among business enterprises can be used to advantage as long as state coordinators do not dictate a formulaic set of decisions. Our experience in Ohio shows that using this approach will produce some overarching themes that transcend local considerations along with some specific concerns that are unique to each region.

Results must be communicated in a way that allows stakeholders to grasp the issues and translate them into practical actions.
An initiative to measure the readiness of a region for global electronic commerce will provide much critical information useful for local efforts around public access, technology literacy, Internet usage, and broadband access for businesses and citizens.

Providing the information in an easy-to-understand format — multiple briefings, each segmented to provide a different perspective on the entire spectrum of indicators — is useful in developing concrete action plans around specific complex issues. Additionally, providing information in such a way that local economic developers can use it for business attraction, retention, and relocation efforts helps to make initiatives like this relevant and broadly supported throughout the region.

Because of the variety of measurement tools used, it would be easy both to confuse the participants and create situations in which discussion focus is lost. Study methods and results discussions need to be segmented to allow time for the participants to understand each in some depth. With that understanding, the implications can be discussed in a meaningful way and translated into actions that are linked to other ongoing economic development efforts.

The project in Ohio organized quarterly meetings where presentations were made about each part of the methodology and the related results. For example, we introduced the overall questionnaires for residential and business users early in the process and received feedback on the nature and wording of the questions. We then devoted a later meeting to the presentation of the residential results and discussion of their implications for the statewide and regional efforts. A similar meeting was used to discuss the business results. Meetings were staged to maintain focus. This staging also assisted in project commitment as new information was given both to the statewide and regional groups at each of the meetings.

Data collection and dissemination efforts must be strongly managed to ensure that results are provided in a timely manner.
Even with strong CEO leadership to guide the project toward positive action, the wide range of data collection requirements across a diverse set of regions within a state require very strong management of the data collection and dissemination effort. The data involve a unique mix of empirical technical information, survey work, and qualitative assessments of websites and government policies. This implies an equally wide range of skills be assem-

bled and managed to bring the project to a successful conclusion. Problems can range from technical support for the person charged with starting up the computer to measure ISP performance to selective review of website assessments to ensure interpersonal measurement consistency to the insistence that project deadlines be met. Without a strong effort in this arena, the other efforts will not receive the relevant data in a timely manner, discouraging the participants and resulting in project failure.

It is obvious that project success is directly related to project management effort. A large regional study is particularly vulnerable to difficult delivery problems because the project is dispersed among a wide variety of participants and workers, because of the project's breadth and complexity, and because managers are not the direct supervisors of many of the workers. At the onset of the project, the first organizational task must be to assemble a project team with the requisite skills to undertake each part of the assessment. This can be through the staff of the lead organization or through subcontracts with other appropriate entities. In the case of the Ohio study, a combination of these methods was used.

Once the study is underway, the execution of each part of the project must then be managed. Here it is important to divide the management tasks and ensure that there is sufficient management time commitment to oversee each of the efforts. It must be kept in mind that project management also must be concerned about management of the statewide and regional steering committees, briefing meetings, media contacts, and other tasks. These responsibilities, let alone the task of overseeing all of the fieldwork, could easily overwhelm a single manager. It will probably take parts of three or four people's management time to ensure that all of the project teams have sufficient oversight.

Completion of a successful project requires careful integration of people and other resources.
With sufficient management resources, it should be possible to define, execute, and complete a successful study of a region's readiness for global electronic commerce within a four to six month timeframe, which is required for the results to be

relevant and actionable. If the guidelines given here are followed, it should place the project managers in a position to integrate data collection, analysis, dissemination, and implementation efforts efficiently and effectively. A strong project plan needs to be established with clear understandings between cooperating analytical groups providing the analysis to assure that information gathered is correct and complete and that deadlines are met.

Concluding Thoughts

Clearly, a state or region benefits enormously from undertaking a broad-based e-commerce readiness assessment. However, the work is less useful than it might be if comparable data for other states, or regional or national averages exist. As noted at the beginning of this study, national performance indicators and benchmarks for a "networked economy" have not yet been developed, nor is standard data being collected by the federal government or other institutions on a consistent, non-proprietary basis. Although many private consulting firms and market research enterprises publish some overall data for public use, these are often inaccessible on a non-proprietary basis.[14] Often sample sizes and methodology cannot be verified and results may be fragmented, misrepresenting the overall trends.[15] This is particularly misleading in the case of more evaluative, subjective areas of analysis.

Over the next decade, regions, states, and the federal government will be taking policy actions that will impact the continued growth and development of the new economy and unleash its transformational potential for many traditional sectors of the economy. Doing so in the absence of critical objective data will retard progress and impede constructive action for the "digital economy" — an industry that operates on "Internet time."

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[14] Many such surveys and survey firms are quoted widely in the technical and general press. The most useful compendium of these surveys is compiled by NUA Surveys at www.nua.com. Other firms with forecasting units and some generally accessible data are: Juno (www.juno.com), IDC (www.idc.com), Harris Interactive (www.harrisinteractive.com), Cyberdialogue (www.cyberdialogue.com), and Forrester Research (www.forrester.com).

[15] A particularly damaging example of this is the current debate raging over the true load placed on the national energy grid from powering the Internet and Web-enabled appliances. See http://enduse/lbl/gov/Projects/InfoTech.html.

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Ms. Sabety has a decade of experience in building technology-led economic development strategies for communities as diverse as San Diego, Denver, and Long Island. The consulting firm she co-founded with former Ohio Governor Richard F. Celeste also managed numerous complex research projects for a number of corporate clients such as Ameritech and Honda R&D Americas, Inc.

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