

MEMORANDUM

To: Hear Us Now.org, Consumer Voice for Communications Choice¹
From: Mikaela Kooiker, Policy Analyst, Municipal Wireless Networks
Date: May 15, 2008

**Community Wireless Networks²
Enabling Internet access as a public good**

Executive Summary

The economic and social potential of wireless broadband is well documented and undeniable. The main problem is achieving universal and equitable access to communities. Internet access is identified as a public good necessitating local government involvement. However, government involvement can manifest in a variety of different forms, some presenting more obstacles than others. Four policy alternatives are examined: Internet as a public utility, nonprofit owned and operated Internet, municipal cooperative wholesale, and a private consortium model. The advantages and obstacles to each model are examined, resulting in a recommendation of a collaborative municipal cooperative wholesale and nonprofit partnership. The recommendation is followed by a short discussion of limitations.

I. Background

Achieving universal broadband Internet access is being voiced as a vital objective internationally. South Korea, Japan, and Finland topped the Information Technology and Innovation Foundation (ITIF) rankings based on Broadband penetration, speed, and cost. The U.S. came in 15th (see Appendix A). While national and state initiatives can provide important support and may explain success for some countries, the diversity of U.S. states and cities reflect

¹ This nonprofit organization is a project of Consumer's Union, which publishes consumer reports. This organization was chosen based on their focus of educating, engaging, and empowering the public with information (<http://www.hearusnow.org>).

² Community Wireless Networks are a general term for wireless networks focused on universal access within an area. Sometimes they are referred to as Municipal Wireless Networks; however, the level of government involvement may vary (Meinrath 2008).

a need for local initiatives that can be more responsive and targeted to community needs. The Internet enhances communication (92% of Internet users communicate through email), provides medical information (80% of users search for medical information), and improves government service provision (66% of Internet users visit local, state, or federal websites) (Pew 2007). Broadband extends these benefits of general Internet use through allowing users to receive and send information faster as well as utilize certain applications that necessitate a high-speed connection (GAO 2006). In addition, the “always on” feature of broadband means greater usability and may explain why these users are more likely to go online daily and be highly active online (U.S. Department of Commerce 2004).

Although broadband connection is the most important factor increasing Internet speed, the wireless subgroup of broadband is considered to provide even greater opportunities. Wireless can be a cheaper method of broadband service for reaching un-served populations, especially in rural areas. The infrastructure costs are substantially less for wireless because there is no need to install cables. In addition, for densely populated areas, wireless fidelity (wi-fi) networks provide “hot spots” of up to 300 feet for access coverage (GAO 2006).

II. Statement of the Problem

The digital divide

Although Internet service has made a huge impact on much of the population, growth has not been uniform or equitable. Approximately 75% of adults in the U.S. use the Internet (Pew 2007). What does this mean for the remaining 25%? The characteristics of the digital divide³ are strikingly parallel to the characteristics of already disempowered groups in the U.S. There is

³ The digital divide refers to the “gap between those who have access and can effectively use information technology and those who cannot” (Wilhelm 2001). This definition of the digital divide is used for its broad, all-encompassing perspective.

a high correlation between household income, age, race, geography (rural vs. urban), and level of education demographics in regards to Internet use (Pew 2007). For household income, age, and level of education there is a 30 to 60 percentage-point difference in Internet use between demographic cohorts. For example, 93% of Americans who completed college or a higher educational attainment use the Internet as compared to 38% of Americans who did not complete high school (Pew 2007).

Internet speed was recently added to the list of factors influencing the digital divide. A Pew study grouped users into three categories: the “truly off-line” (22%); “intermittent users, dial-up users, or non-users who live with an Internet user” (40%); and “highly-wired broadband elite” (33%) (Fox 2005). The study’s main findings reported that access speed greatly affects activity online. Although the GAO reported slightly different percentages, the trends remain the same (see Appendix B). In addition, the GAO results on the digital divide in relation to factors influencing broadband access precisely mirror the 2007 Pew study (see Appendix C) (GAO 2006). Furthermore, the digital divide is not showing major signs of change. From 2003 to 2005, the percentage of American adults who had never used the Internet or email and without an Internet connection only decreased 1% (to 22% in 2005) (Fox 2005).

Internet as a public good

The Internet developed as a government tool for the U.S. Department of Defense; however, today private companies dominate as Internet service providers. Inequitable access, partly attributable to lack of profitability for private business, has resulted in requests for government to take action to improve Internet access. Furthermore, there is a historical precedent for government to provide public goods and services (Banker, Jain, Mandviwalla 2007 (2)). Should the Internet be considered a public good?

The UN Global E-government readiness report affirms:

Access to information and communications is considered crucial for poverty reduction, since it contributes to new sources of income and employment for the poor, improved delivery of health and educational services and competitiveness of the economy. (United Nations 2005, ix)

Although their report addressed Internet access within the international context where the U.S. ranked #1 (United Nations 2005), their assertion is just as applicable to the U.S. as it is to any other country. I assert that the Internet's social and economic empowerment features, positive externalities, and enhancement of government services identifies it as a public good. Therefore, the current inequity of Internet access and the public good qualities of the Internet's potential to act as a leveling agent necessitates local government involvement.

Obstacles for government involvement

Local government involvement, while determined essential for Internet provision, can have some serious obstacles. There are four main obstacles: competition, dynamism, cost, and state legislation. First, government provision of subsidized or free service can reduce competition and possibly give "inferior technology an artificial support (Elig 2006). In addition, competition and profit drive further innovation, so government involvement could also hinder continued innovation. However, profit motive for private companies is part of the equity problem because it has supported innovation primarily for upper-to-middle class customers (U.S. Department of Commerce 2004). Second, information technology oftentimes necessitates quick and continuous change that some local government may not be accustomed to (Banker 2007 (2)). Third, large and ongoing investment is needed. Wireless networks are not one main fixed cost, but instead need ongoing funding for incorporating new technology and in light of short depreciation schedules (Elig 2006). These costs may be hard to substantiate due to fiscal constraints in cities that mean money would need to be diverted from other programs (Maitland, Tapia). However, earned revenue from Internet service provision could offset the non-profitable

investments and expansions (Maitland 2006). Lastly, cities must follow state law and at least 15 states passed laws regulating types of government involvement in wireless Internet services (Maitland, Tapia).

III. Primary stakeholders: benefits of improving access and capitalizing on wireless capabilities

The Internet and wireless technology make important contributions to the economy of cities and communities. However, this technology is not being fully exploited. There are many ways to improve technology access such as maximizing use of already existing government infrastructure, such as lamp posts, that can geographically disperse wireless networks and lower cost of service (Banker, Jain, Mandviwalla 2007 (2)). In addition to addressing the digital divide, improving Internet access, use and connectivity speed would have many positive externalities and provide a multitude of opportunities to stakeholders. See Appendix D for the complete stakeholder analysis.

Municipal Government

One opportunity for local government is enhancing government-to-citizen interaction for underserved or disadvantaged populations, a change already noted for those who have access. The 2002 Pew study found that 54% of officials stated that email brought them into contact with citizens they had not heard from before (Pew 2002). In addition, a correlation was found between the level of public access and how much local officials use of email, blogs, and Internet communication (Pew 2002). There may be many reasons why local officials in some areas do not use the Internet more, but one reason given is that it currently does not provide for equitable communication with constituents. Right now the Internet does not foster that communication, but as more people gain access, local officials' may increase their Internet communication,

which could benefit all constituents and better facilitate citizen feedback. Internet users have expressed that e-government has improved their relationship with government (Pew 2004). E-government has potential to increase public trust, improve transparency, increase convenience, and encourage innovation (Moon 2004). The possibility is present that improving access may have positive repercussions for engaging formerly disenfranchised populations in local government.

In addition to government-to-citizen interaction, wireless networks have the potential to transform government services by employing mobile technology. Mobile technologies can be especially well utilized for safety and emergency services (Moon 2004). Wireless technology is already used in California to transmit information about energy warnings, traffic jams, and the state lottery (Moon 2004). The possibility of wireless networks to increase efficiency and improve communication for municipal services holds promising results.

Internet providers

Current Internet providers comprise another large stakeholder group. Their main interest is keeping market share and ensuring that they are able to capitalize on any investments they have already made in infrastructure. Local government holds some market advantages, most importantly access to public infrastructure that could be used for dispersing wireless nodes for access throughout a city. Internet providers hold substantial lobbying power nationally and within states, therefore facilitating an equitable and a collaborative effort would be the best solution to address their concerns about government involvement and decrease the possibility of government monopoly.

Private business

Broadband wireless communication has an incredible capability to transform workers' lives. Wireless has the ability to increase employee productivity, allow for greater mobility, keep costs low, and improve communication systems (Chang & Kannan 2003). A study conducted to measure economic impact of broadband based on a zip codes assessment affirmed that broadband access and penetration had a positive impact on growth in number of businesses, especially in the IT sector (Gillett 2005). General productivity increases for businesses, especially small businesses could be large as a result of wireless networks.

Low or non-Internet users/ Underserved

Although 32% of non-Internet users say they are not interested in going on-line, 31% report their main obstacle as access (Fox 2005). Both of these groups represent two important needs. Outreach and marketing are two methods for engaging the passive first group to ensure that they are fully aware of the possibilities of the Internet. The interests of the second citizen stakeholder group may be most focused on cost. However, communities' interests and needs may vary and therefore gaining community support is essential to ensure sufficient demand and overall success of community networks.

IV. Policy alternatives and Analysis

Realizing the potential of the Internet "requires cultivating human capacity and changing the ways in which both professionals and citizens behave" (Garson 2006, 109). Four policy alternatives are discussed below as means to "cultivate human capacity" and facilitate change. The four alternatives represent different models for government assisted community wireless networks (see Appendix E & F). They illustrate different roles that government can play

including government as broadband user, rule-maker, financier, or infrastructure developer as outlined by Gillet, Lehr, and Osorio (2004).

Solely government owned and operated options were discarded due to lack of functionality in meeting criteria described below, most specifically absence of consensus on government's role, sustainability, and effectiveness in making quick and ongoing technological changes (Feser 2007). Likewise, solely private owned and operated options were discarded based on the need to address inequity and public good characteristics of Internet access.

Criteria

The following criteria are used to assess the alternatives identified as possible solutions to improve Internet and wireless access.

- *Effectiveness*: Does the policy alternative effectively address the majority of stakeholders' interests?
- *Political Acceptability*: Will the policy alternative receive political support, especially in light of obstacles to government involvement?
- *Sustainability*: Once implemented, will the policy alternative be financially sustainable?
- *Level of Coverage*: What percentage of the target population will have improved Internet access as a result of the alternative proposed?

Option 1: Internet as a public utility

Wireless broadband networks could be set up as a public utility similar to water and electricity services. Municipal government's role would be regulatory and financial (Fesenmaier, Jain, Mandviwalla, et al. 2008). A public utility would effectively meet many stakeholder interests, with the exception of Internet providers (***)). A public utility would have the advantage of access to public infrastructure and subsidies in comparison with private Internet

companies. Internet as a public utility would not receive strong political support (**) because of dependence on tax dollars and its positioning in direct competition with the private sector, which would not easily facilitate positive partnerships (Maitland, Tapia, Stone 2006). In relation to sustainability, a public utility's likely reliance on tax dollars decreases the viability of this option, especially if large investment is needed for rural access (**). However, local government's regulatory role would ensure control over coverage and price to the end user, which could be set up on a sliding scale to provide equitable access (*****).

Option 2: Non-profit owned and operated

Local government's role for a non-profit owned and operated wireless network would be primarily financial through tax-exempt status and grants. The nonprofit would be bound to its tax-exempt status and therefore accountable to the government and community. Nonprofits have a strong advantage in meeting stakeholder interests (****) because they can provide a local, community-driven approach to wireless broadband distribution by "encouraging broadband from the bottom up" (Feser 2007). Nonprofits would provide a slightly different service than for-profit providers and therefore would not be in direct competition with them. Therefore a nonprofit model could more easily encourage collaborative efforts. The nonprofit model has high political acceptability (*****) because government's role can be more supportive rather than as an active participant. In regard to sustainability, a nonprofit Internet network is less optimal (**). A nonprofit would have a significantly reduced revenue stream because it must uphold its tax-exempt status. Lastly, a nonprofit's level of coverage has the potential to be excellent because it would be geared toward community needs for access (****), however, the cost of providing ideal coverage may be prohibitive.

Option 3: Cooperative wholesale

A cooperative wholesale model indicates that the municipality would own wireless network infrastructure. They would then sell service to private providers at wholesale costs to manage and resell on a value-added basis (Fesenmaier, Jain, Mandviwalla, et al. 2008). This model does allow municipalities to fully maximize use of current assets, like lampposts, for wireless distribution. This model would effectively meet many stakeholders' needs, however, government ownership and advantages would pose a problem for private Internet providers. The main difference between the cooperative wholesale model and the utility model is that the wholesale model is not restrictive and could encourage competition and private-public partnership (therefore receiving ****). The main disadvantage of the cooperative wholesale model is that many government obstacles are not innately addressed and may not be as politically viable (**). In relation to sustainability, the government would have a revenue source from sold service, but minimize cost of management and allow for a more dynamic for-profit business model (****). The initial investment would require state or federal grants, private donation, or bank loans to the city (Fesenmaier, Jain, Mandviwalla, et al. 2008). Lastly, this model would provide for excellent coverage because it would be based on equitable distribution through the government (*****).

Option 4: Private consortium

A private consortium is most in-line with private provision of Internet services; however, cities would provide use of public assets in exchange for some share of revenue and oversight (Maitland, Tapia, Stone 2006). The private ownership aspect of this model means this option would not be as inclusive of all stakeholder interests (**), especially non-users' needs. Although this model is politically acceptable by limiting government involvement, it still may provide an unfair advantage to one provider over another (**). This option is the most

sustainable (*****) because it is driven by profit and government financial involvement could be limited to tax incentives. Lastly, the private consortium model may provide better coverage than a purely private model, but because the Internet provider is driven by profit equity issues will most likely still remain an issue (***)

Decision matrix

The following decision matrix charts the policy options against the four criteria discussed to determine which policy provides for the best outcomes. Each option is rated through a system ranging from one to five stars (*) to indicate the degree to which it satisfies the criteria. One star (*) is the lowest rating and signifies that the policy option does not accomplish the desired outcome. Five stars (*****) indicate that the desired outcome is completely fulfilled by the policy option.

Options/Criteria	Effectiveness	Political acceptability	Sustainability	Level of Coverage	Total
(1) Internet as a public utility	***	**	**	*****	12
(2) Non-profit owned and operated	****	*****	**	****	15
(3) Cooperative wholesale	****	***	****	*****	16
(4) Private consortium	***	***	*****	***	14

V. Policy Recommendations

Based on the decision matrix, I recommend a combination of a cooperative wholesale model in collaboration with a non-profit. These two models are best able to address and manage diverse stakeholder interests, political support, financial sustainability, and full coverage to address the digital divide.

VI. Limitations

There are three main limitations to the above decision-matrix and policy recommendation. First, even though improving Internet access is a significant factor contributing to the digital divide, other factors can influence an individual's ability or motivation to use the Internet even if accessible. Therefore any of the policy alternatives addressed in this paper need to be provided in conjunction with educational outreach, training, and marketing campaigns.

Secondly, broadband wireless coverage is a hot topic and appears to have a lower unit cost than other broadband service methods for increasing equitable distribution of the Internet, but other options may possess alternative benefits. The GAO report mentioned up-coming development to use power lines for Internet service provision, WiMAX (an upgraded version of wireless) or improved satellite service (GAO 2006).

Third, although community initiatives may create programs most well suited for individuals, federal and state incentives and supports can play an important role, especially in regard to funding. Appendix G illustrates the percentage of GDP that the top countries allocate toward telecommunication investment. Investment may not equal success, but for South Korea and a few other top investor countries, their investment may reflect why they also leading in global broadband rankings.

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Appendix A

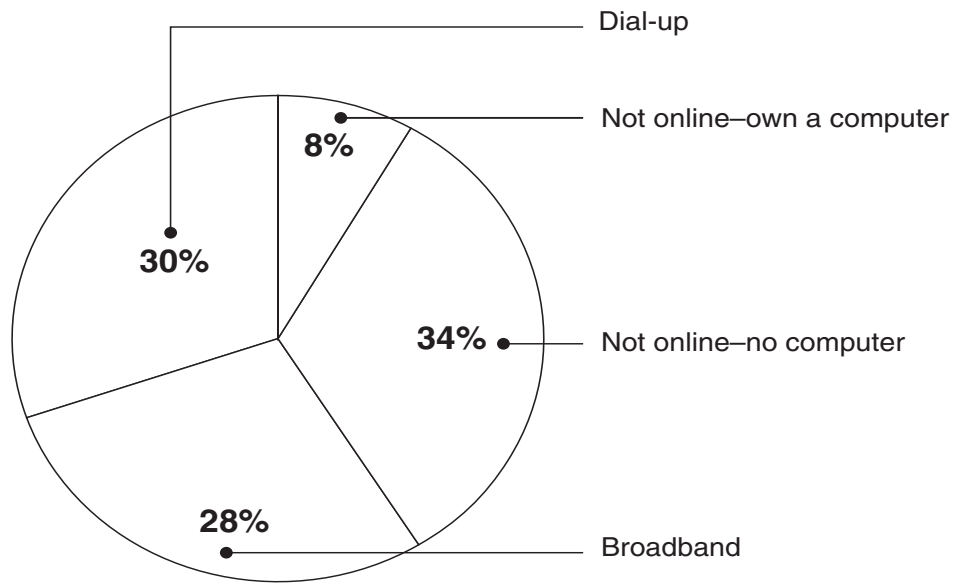
2008 ITIF Broadband Rankings¹

Ranking ²	Nation	Score on Specific Broadband Measures			Composite Score ⁶
		Household penetration ³ (Subscribers per household)	Speed ⁴ (Average download speed in Mbps)	Price ⁵ (Lowest monthly price per Mbps) (US \$ purchasing power parity)	
1	South Korea	0.93	49.5	0.37	15.92
2	Japan	0.55	63.6	0.13	15.05
3	Finland	0.61	21.7	0.42	12.20
4	Netherlands	0.77	8.8	1.90	11.77
5	France	0.54	17.6	0.33	11.59
6	Sweden	0.54	16.8	0.35	11.53
7	Denmark	0.76	4.6	1.65	11.44
8	Iceland	0.83	6.1	4.93	11.20
9	Norway	0.68	7.7	2.74	11.05
10	Switzerland	0.74	2.3	3.40	10.78
11	Canada	0.65	7.6	3.81	10.61
12	Australia	0.59	1.7	0.94	10.53
13	United Kingdom	0.55	2.6	1.24	10.30
14	Luxembourg	0.56	3.1	1.85	10.25
15	United States	0.57	4.9	2.83	10.25
16	Germany	0.47	6.0	1.10	10.17
17	Belgium	0.57	6.3	3.58	10.17
18	Portugal	0.44	8.1	1.24	10.15
19	New Zealand	0.42	2.5	1.05	9.68
20	Spain	0.49	1.2	2.27	9.68

(Atkinson, Correa, Hedlund 2008)

Appendix B

Figure 1: Status of Household Computer Ownership and Internet Connection

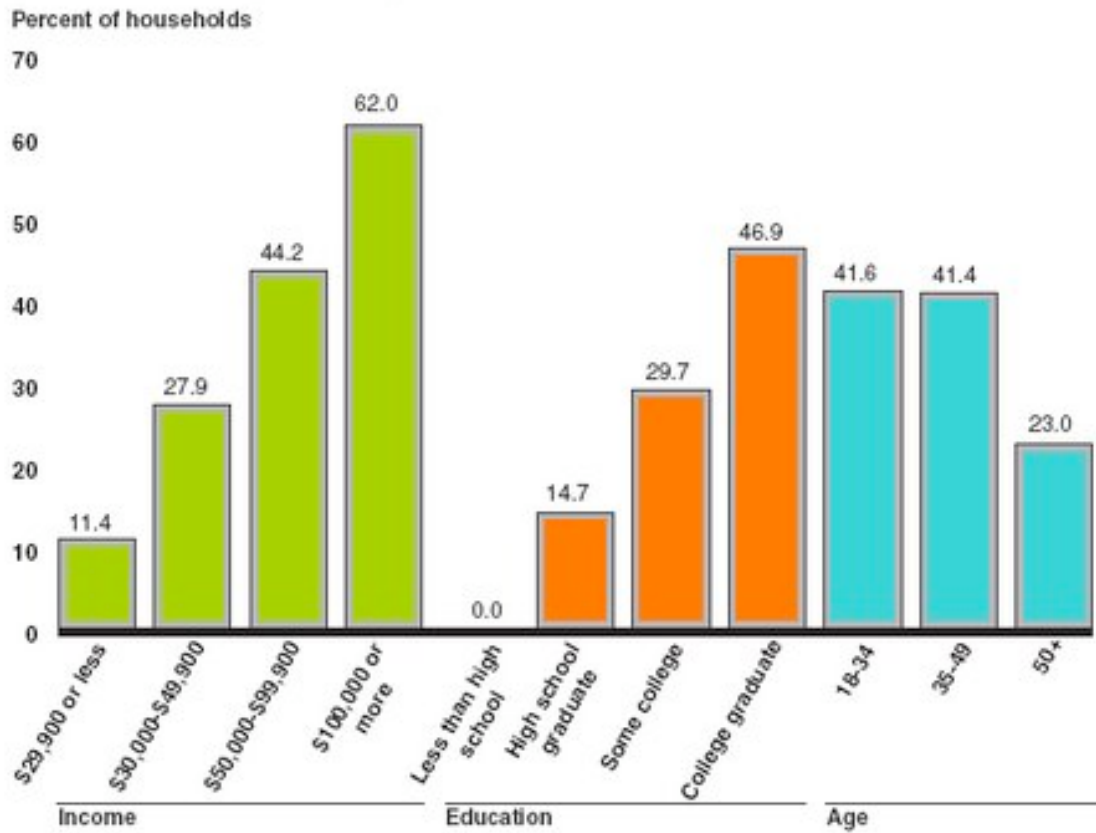


Source: GAO analysis of Knowledge Networks/SRI's *The Home Technology Monitor™: Spring 2005 Ownership and Trend Report*.

(GAO 2006)

Appendix C

Factors Influencing Subscription to Broadband



Source: GAO analysis of Knowledge Networks/SRI's *The Home Technology Monitor™: Spring 2005 Ownership and Trend Report*.

(Connecting Rural Communities)

Appendix D
Stakeholder analysis

Stakeholders	Interest in the issue / what is at stake
Primary Stakeholders	
City Government	-Public goods provision, enhance public services (police, traffic, etc) through use of wireless devices
Internet providers	-Profits, already invested infrastructure, fair practices
Business (generally small businesses)	-Reduce cost, expand opportunities, innovation
Low-or-non Internet users/ Underserved	-Potential economic, educational, and lifestyle improvements
Secondary Stakeholders	
General Public	-Low cost Internet, education, potential lifestyle improvements, taxes
Large Businesses	-Strong labor force, telecommuting, security (generally have and will keep private Internet service)
State Government	-Equitable Internet access, competitive labor force, economic progress, granted decision-making authority over instituting muni wifi
Non-profits	-Educational training opportunities, partnership opportunities
Public Schools	-Further educational opportunities, cost savings in infrastructure
Minor Stakeholders	
Federal government	-Competitive labor force, economic progress, provided legislative approval for states to decide on municipal wireless networks; antitrust legislation; fair business/government practices
Students	-Low cost Internet
Tourists	-Ease of travel attraction

(Fesenmaier, Jain, Mandviwalla, et al. 2008, p73), (Banker, Jain, Mandviwalla 2007)

Table of Importance and Influence

The table below lists all stakeholders and ranks their level of importance and influence on the current issue. The level of influence demonstrates the amount of power the stakeholder has in changing the current situation.

Stakeholders	Level of importance of the issue	Level of influence on current situation
City Government	5	4
Internet providers	5	4
Low-or-non Internet users/ Underserved	4	2
General Public	2	3
Small Businesses	5	2
General Businesses	2	3
State Government	4	5
Non-profits	3	2
Public Schools	4	2
Federal Government	4	4
Students	4	1
Tourists	3	1

(5=highest level of importance/influence, 1=lowest)

Importance/Influence Matrix

This matrix plots the importance/influence of each stakeholder into quadrants.

High Importance/
Low Influence

High Importance/
High Influence

A. Low-or-non Internet users Small business Non-profits Public Schools Students	B. City Government Internet providers State Government Federal Government
C. General public Tourists General Businesses	D.

Low Importance/
Low Influence

Low Importance/
High Influence

Appendix E
Municipal broadband Internet service models

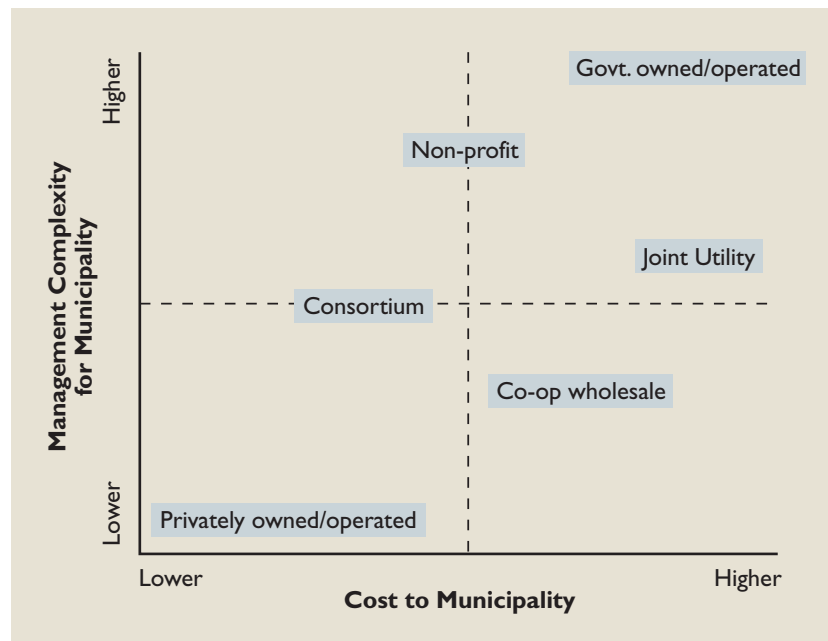
A. Tapia et al. / Government Information Quarterly 23 (2006) 359–380



Fig. 1. The municipal broadband business model continuum.

(Maitland, Tapia, Stone 2006)

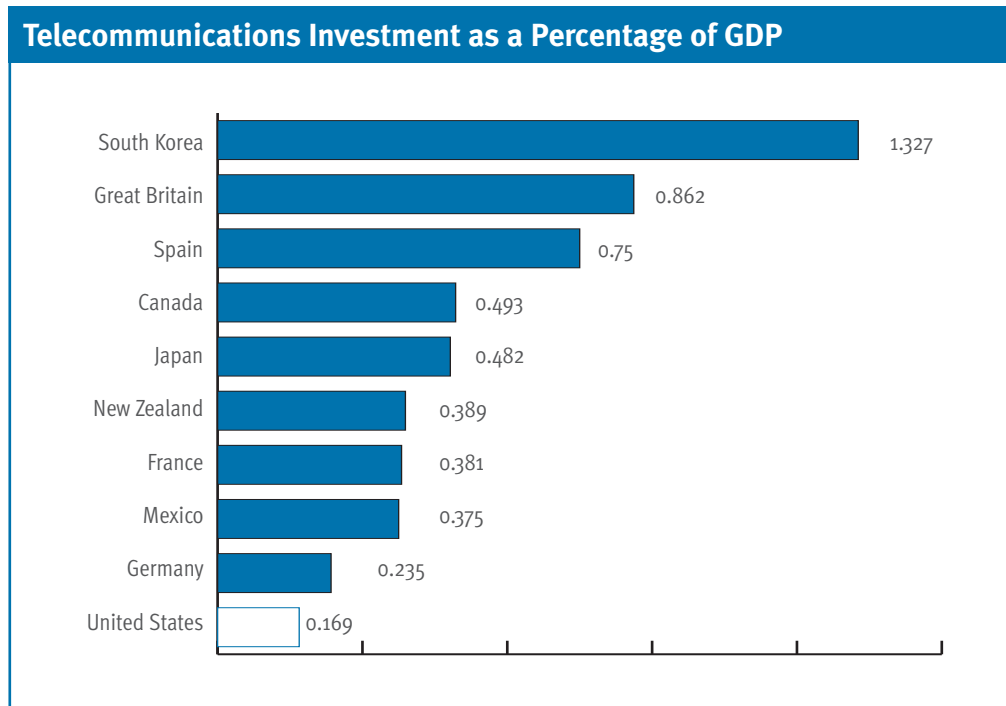
Appendix F
Comparing MWN management and funding models
(Fesenmaier, Jain, Mandviwalla, et al. 2008, p76)



Attributes / Model	Sample Key Issues	Government owned and operated	Government owned and privately operated	Joint power authority or public utility	Non-for-profit owned and operated	Cooperative wholesale model	Enterprise/Private Consortium owned and operated	Privately owned and operated
Overall Description		Municipality owns and operates the infrastructure	Municipality owns the infrastructure; subcontracts operation to a private party	Similar to a utility which operates on a for-profit mission	Organization takes advantage of tax regulations governing non-profits	Municipality owned, and capacity is sold at wholesale to private providers	Owned and operated by private enterprise, fees shared with government	Owned and managed by private enterprise
Governance								
Ownership	Who owns the infrastructure (antenna)	Municipality	Municipality	Utility	Not for profit organization	Municipality	Private organizations/ consortium	Privately owned
Policies	Who has access? What is appropriate usage?	Commission sets and implements policy	Commission sets policy that is implemented by private party	Regulatory guidelines from municipality, operational policies set by utility managers	Regulatory guidelines from municipality, operational policies set by managers	Commission sets and implements policy	Commission sets policy that is implemented by private parties	Commission sets policy that is implemented by private enterprise
Management	Who is responsible for connection problems?	Municipality	Private parties, with oversight from municipality	Utility managers with oversight from municipality	Organization managers with oversight from municipality	Municipality	Private parties with oversight from municipality	Private enterprise with no or minimal oversight from municipality
Finances								
Startup funding	Who will pay for the startup costs?	Grant, donation, government allocation, loan/bond	Grant, donation, government allocation, loan/bond, private funding	Grant, donation, government allocation, loan/bond	Grant, donation	Grant, donation, government allocation, loan/bond	Grant, donation, government allocation, loan/bond, private funding	Loan, private and/or equity funding
Continuing "Profit / Costs"	How will the profits/deficits be handled?	Invested in municipality and upgrades	Divided between profit taking and investment in infrastructure	Invested in upgrades to the system	Invested in upgrades to the system.	Invested in upgrades to the system.	Profits shared between operators and upgrades	Operated no different from any private business
Upgrade	How will upgrades be implemented and funded?	Funded through selectively applied fees	Funded through profits	Funded through profits	Funded through profits	Funded through sale of excess capacity	Funded through profits	Funded through profits

Appendix G

Investing in Telecommunications



Source: ITU, Connect the World Database, 2006.

(Communications Workers for America 2006)