Columbia Business School

State Government intervention in financing broadband and wireless infrastructure

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Agenda

1. Should State governments take a more active funding role?
2. What are the potential modes of intervention?
3. What are the risks of state intervention?
4. Conclusion

Telecommunications networks have a positive impact on economic development

- Generate jobs and output as a result of the construction of networks
  - Estimates for network construction jobs are fairly robust and consistent with prior research
  - Employment multipliers: between 1.92 and 3.42
  - Output multiplier: every dollar invested in infrastructure, generates 0.83 dollars in domestic value added
- Promote innovation, and creation of new businesses once the networks are deployed
  - Accelerate development of core regions
  - Attract new industries, with employment potential

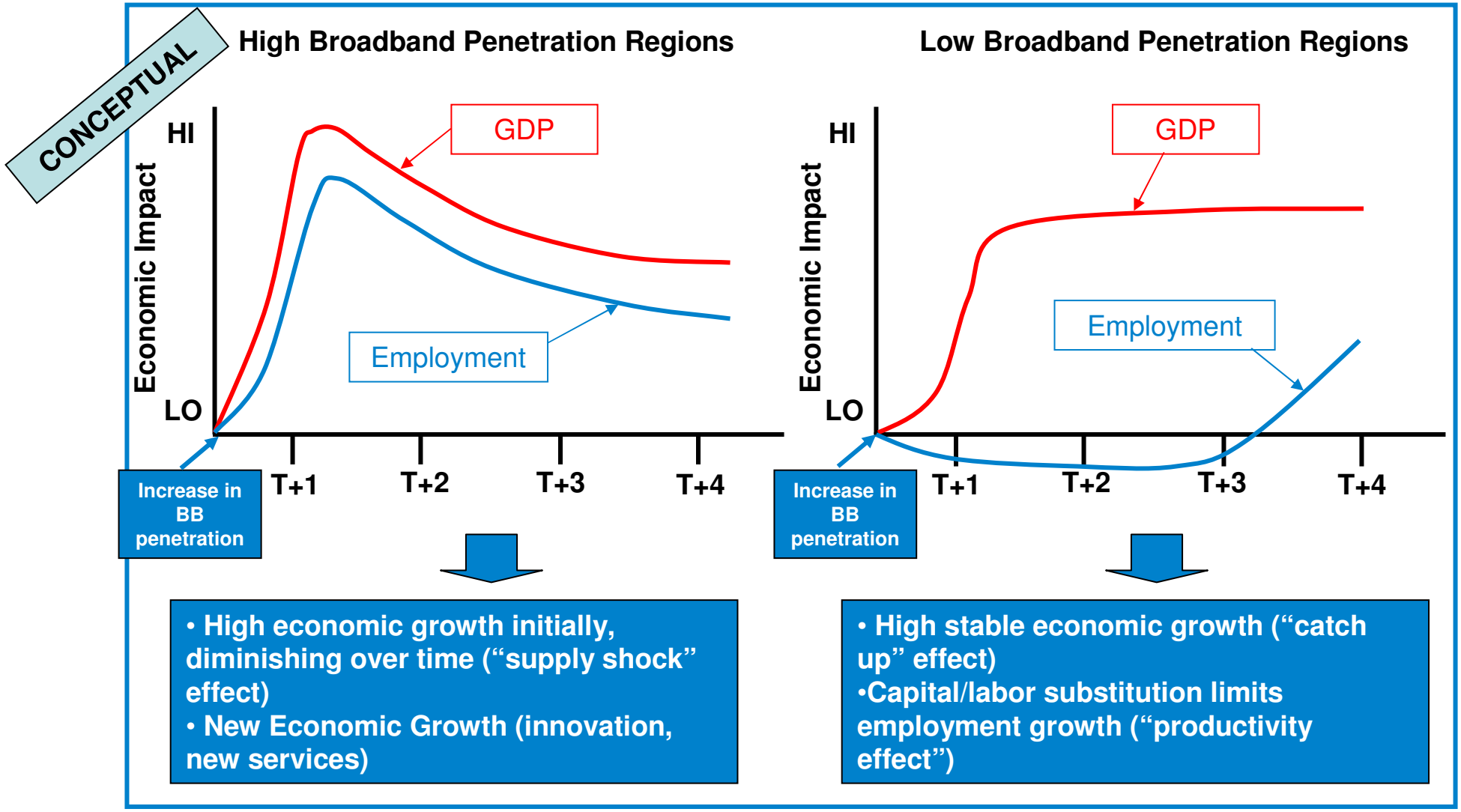
Three types of network construction economic effects exist

EFFECT	DESCRIPTION	EMPLOYMENT EXAMPLES
Direct jobs and output	• Employment and economic production generated in the short term in the course of deployment of network facilities	• Telecommunications technicians • Construction workers • Civil and RF engineers
Indirect jobs and output	• Employment and production generated by indirect spending (or businesses buying and selling to each other in support of direct spending)	• Metal products workers • Electrical equipment workers • Professional Services
Induced jobs and output	• Employment and production generated by household spending based on the income earned from the direct and indirect effects	• Consumer durables • Retail trade • Consumer services

Once the networks are deployed, the positive externalities derived from broadband are significantly higher

EFFECT	DESCRIPTION	EMPLOYMENT EXAMPLES
Productivity	• Improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband	• Marketing of excess inventories • Optimization of supply chains
Innovation	• Acceleration of innovation resulting from the introduction of new broadband-enabled applications and services	• New applications and services (telemedicine, Internet search, e-commerce, online education, VOD and social networking) • New forms of commerce and financial intermediation
Value chain recomposition	• Attract employment from other regions as a result of the ability to process information and provide services remotely	• Outsourcing of services • Virtual call centers • Core economic development clusters

Research indicates strong positive externalities of broadband networks building over time in all geographies



However, private investment in broadband networks naturally tends to flow to areas with high population density

DENSITY AND SIZE OF DEMAND	MARKET STRUCTURE: SEVERAL OPERATORS	2-3 OPERATORS	ONE OPERATOR	NO OPERATOR
HIGH	Dense urban areas with high business and residential density			
MEDIUM		Urban areas/towns with primarily residential density		
LOW			Rural areas with sparse residential density	
VERY LOW				Rural areas with very low density

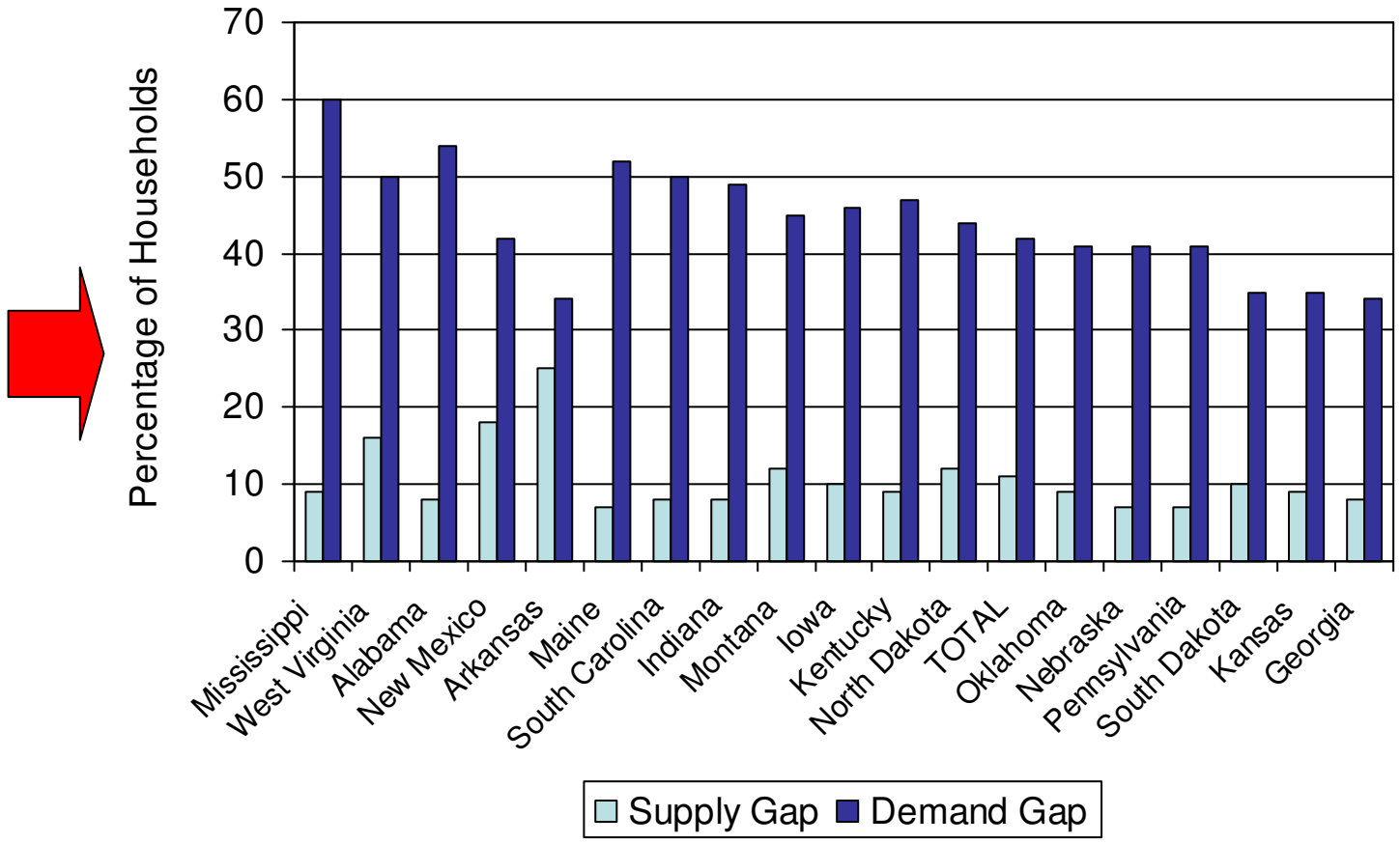
Source: Adapted from Analysis Mason

Therefore, a number of US regions lack broadband and/or wireless access; however, service provision is a supply and a demand issue

BROADBAND SUPPLY VS. DEMAND GAP IN US STATES

Supply Gap: total number of state households minus households served by at least one broadband provider (cable or telco)

Demand Gap: total number of households served by at least one broadband provider (cable or telco) minus household broadband penetration



Source: FCC Form HSDP 1207; Census Bureau; analysis by the author

While the BTOP is trying to address this problem, it is unclear whether it is enough of an incentive to solve for the market failure

- Impact of political causes: the relatively vague Congressional criteria invite people to tie their favorite causes to the criteria for grant selection.
- Sustainability of projects approved: what if funds go to shadow opex pockets as opposed to be solely focused on capex?
- Slow time to market resulting from limited staff, high number of proposals and cumbersome approval process
- Inadequate evaluation that allows to keep all projects on track and support those that undergo deployment problems, while pulling the plug on those that do not perform
- Limited independent auditing

Should state and local governments try to do something more in addition to the activity of Federal stimulus?

- In fact, a lot is being done already in addition to the BTOP
  - The Rural Utility service provides low-interest loans to “rural broadband” projects which could include fiber although most have been for either WiMax or other wireless technologies
  - Launched a $400 million, nationwide pilot program to promote broadband for health care facilities
  - The Universal Service Fund indirectly subsidizes broadband when the deployment costs are lumped into a rural operator’s overall costs
  - Currently considering reforming the USF ($7 billion) in order to be able to support broadband deployment in remote areas
  - Some states have programs to make rights of way easier to obtain at lower cost to help promote “fiber deployment”
- Is that enough?

There is an area where state intervention is acceptable

- "In the case of broadband deployment, if a project does not generate investment because it does not represent a sound financial business case to a carrier, government intervention can be justified if the expenditures are outweighed by the broader socio-economic benefits."

  Source: *Readiness Framework and Sustainability Model for Broadband*, Carleton University and Strategic Networks Group for Industry Canada and Government of Ontario, March 2005; see http://broadband.gc.ca/pub/program/case_studies/carleton/carleton_en.pdf

- The question is how should the State intervene?

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Our premise: governments should focus their intervention alleviating the constraints of a financial model on very selected cases

- If the region cannot attract private investment, there is a substantial public policy challenge:
    - Deal with a monopolistic situation (utility regulation?) or no privately owned broadband at all (government ownership?)

    OR

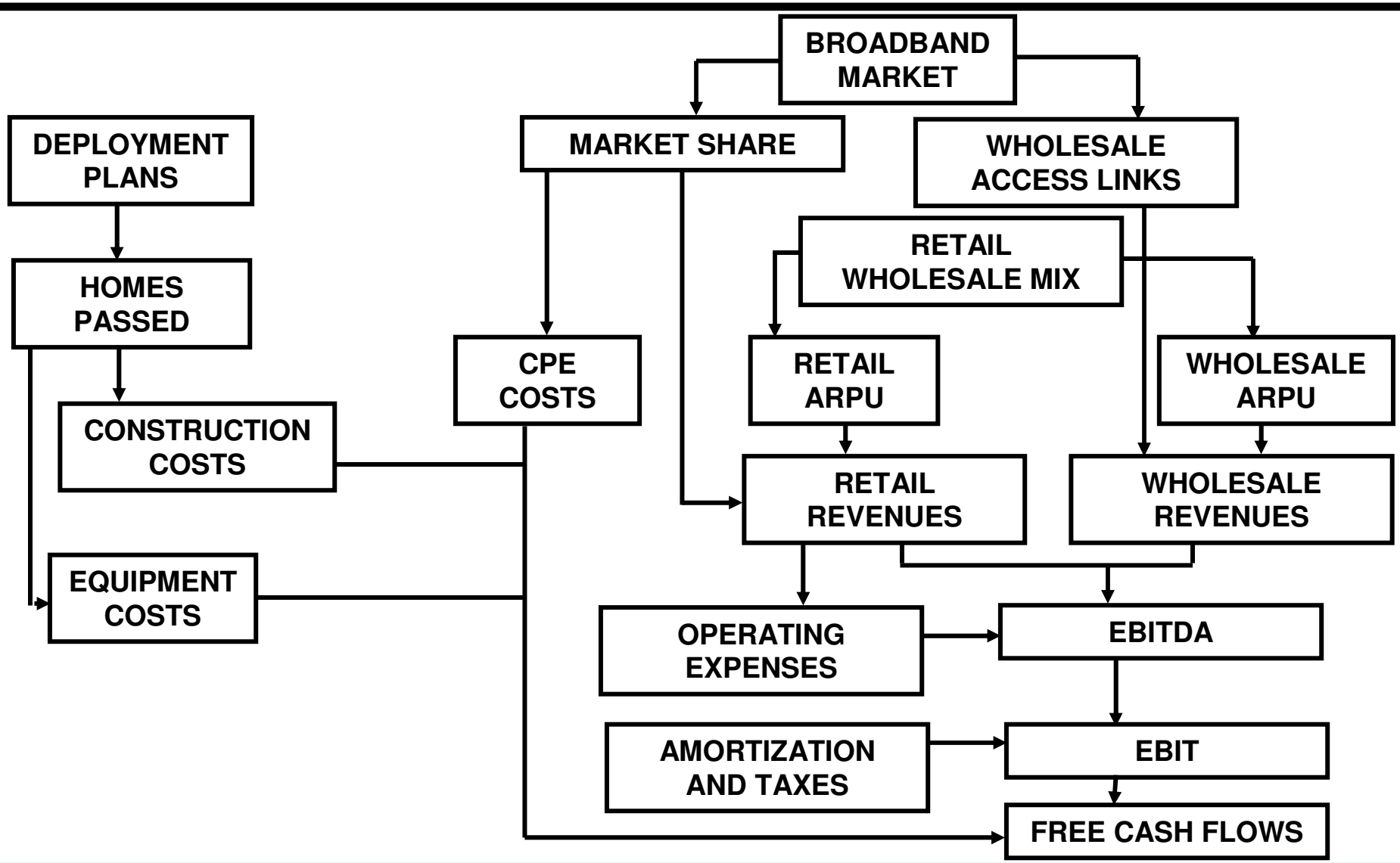
    - Create an environment that can attract investment?
- In general, we recommend not to attempt to build a state-owned facility
    - Less dynamic and innovative
    - No checks and balances
    - More regulation, particularly to protect open access
    - Some unintended consequences in terms of utility behavior (pricing, erosion of public good, etc.)
- We recommend using the power of the state as a catalyst of private investment

Determining where Government involvement is necessary is the first policy decision

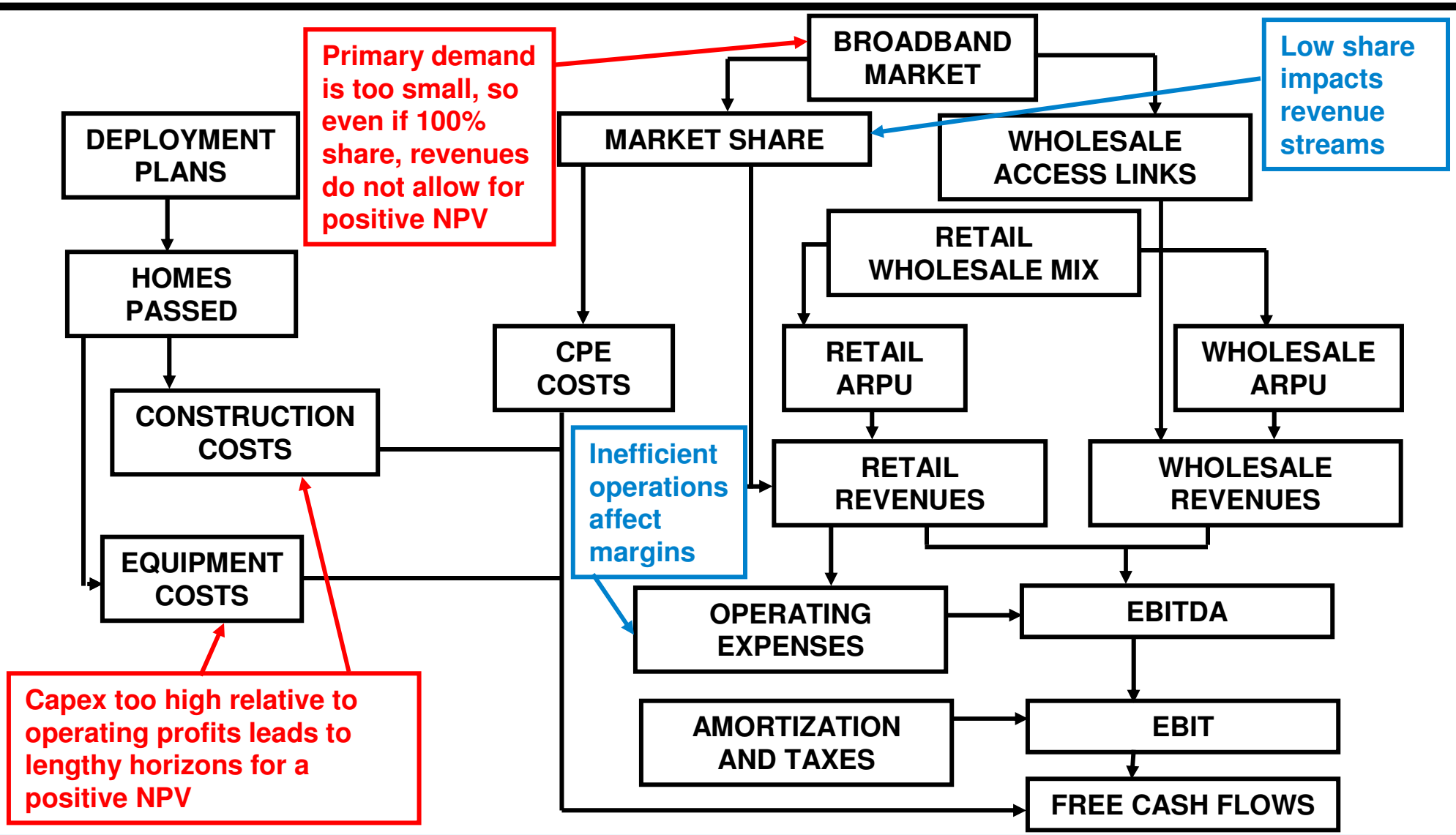
- “Which communities can be, or are, served by market forces?
- Which communities will need assistance with initial investment to become self-sustaining?
- Which communities cannot become self-sustaining and will require ongoing funding?”

Source: *Readiness Framework and Sustainability Model for Broadband*, Carleton University and Strategic Networks Group for Industry Canada and Government of Ontario, March 2005; see, http://broadband.gc.ca/pub/program/case_studies/carleton/carleton_en.pdf

The development of a policy framework to guide government intervention should start by examining an investment model



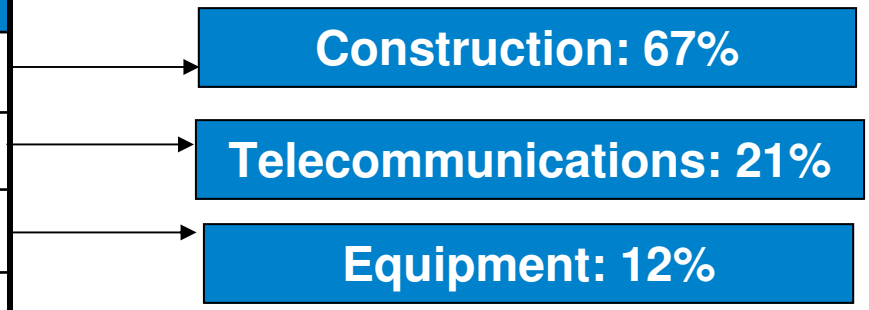
A sustainable broadband business case presents two structural challenges, and two strategic and operational ones



The capex structural challenge differs according to the type of network: in fixed broadband, construction costs are the largest cost item

TELCO CARRIER BREAKDOWN OF NGAN OPEN ACCESS NETWORK

Category	Access costs	Customer premise costs	Backbone costs	Total
Construction	54 %	11 %	2 %	67%
Telecommunications	20 %	1 %	0 %	21%
Electronic equipment	0 %	0 %	11 %	12 %
Total	74 %	12 %	13 %	100 %



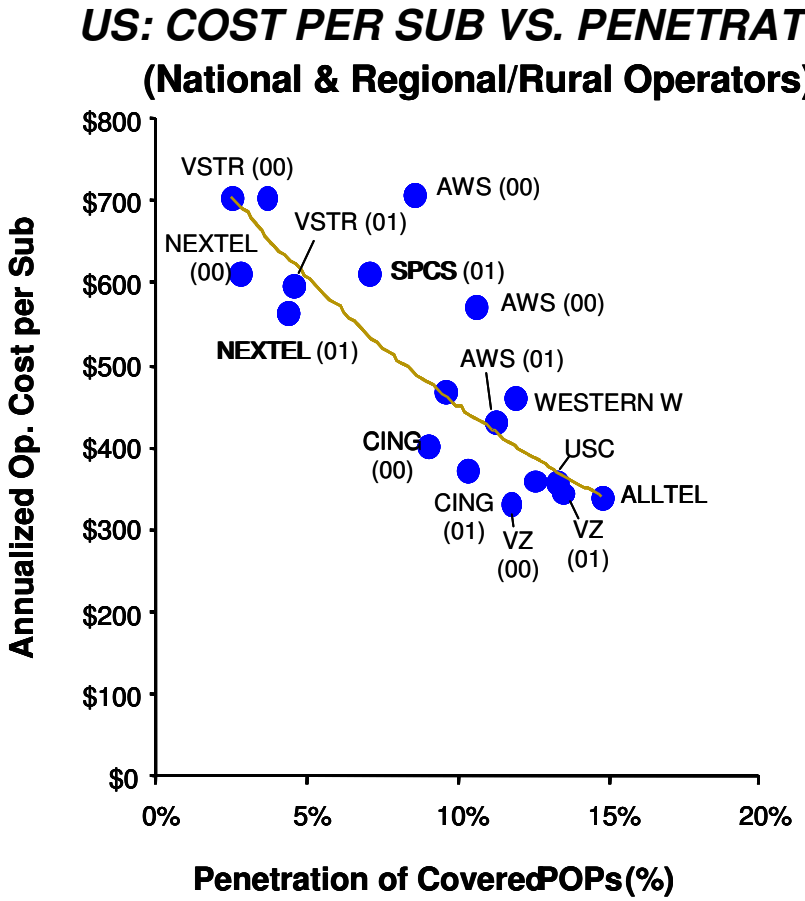
In wireless, the main problem is backhaul

RURAL DEPLOYMENT CASE STUDY: HOWELL, WYOMING

Non-recurring Expenses	Amount Spent
Backhaul antennas (Pacific Wireless parabolic dishes)	$700
Backhaul radios (Tranzeo TR-5Plus-Nf)	$500
Access point radio (Deliberant DLB-2100 802.11	$100
Access point antenna (Omnidirectional, 12 dBi)	$60
High strength mount for rancher's barn (custom fabricated steel)	$250
Power conditioning equipment/building electrical system upgrade	$500
Other parts, including cables, lightning protection, cabinets	$600
Labor and misc expenses	$400
Grand Total	$3110

Coverage: 40+ square miles, depending upon terrain and interference levels; Recurring cost/month: $120 (partially in kind); Node capacity: ~36 Mbps (can be expanded); Overhead is sufficiently low that service pricing is determined not by cost of site but by cost of bandwidth at "head end" (bandwidth + "special access" charges). Cost is far, far less per square mile than any other medium!

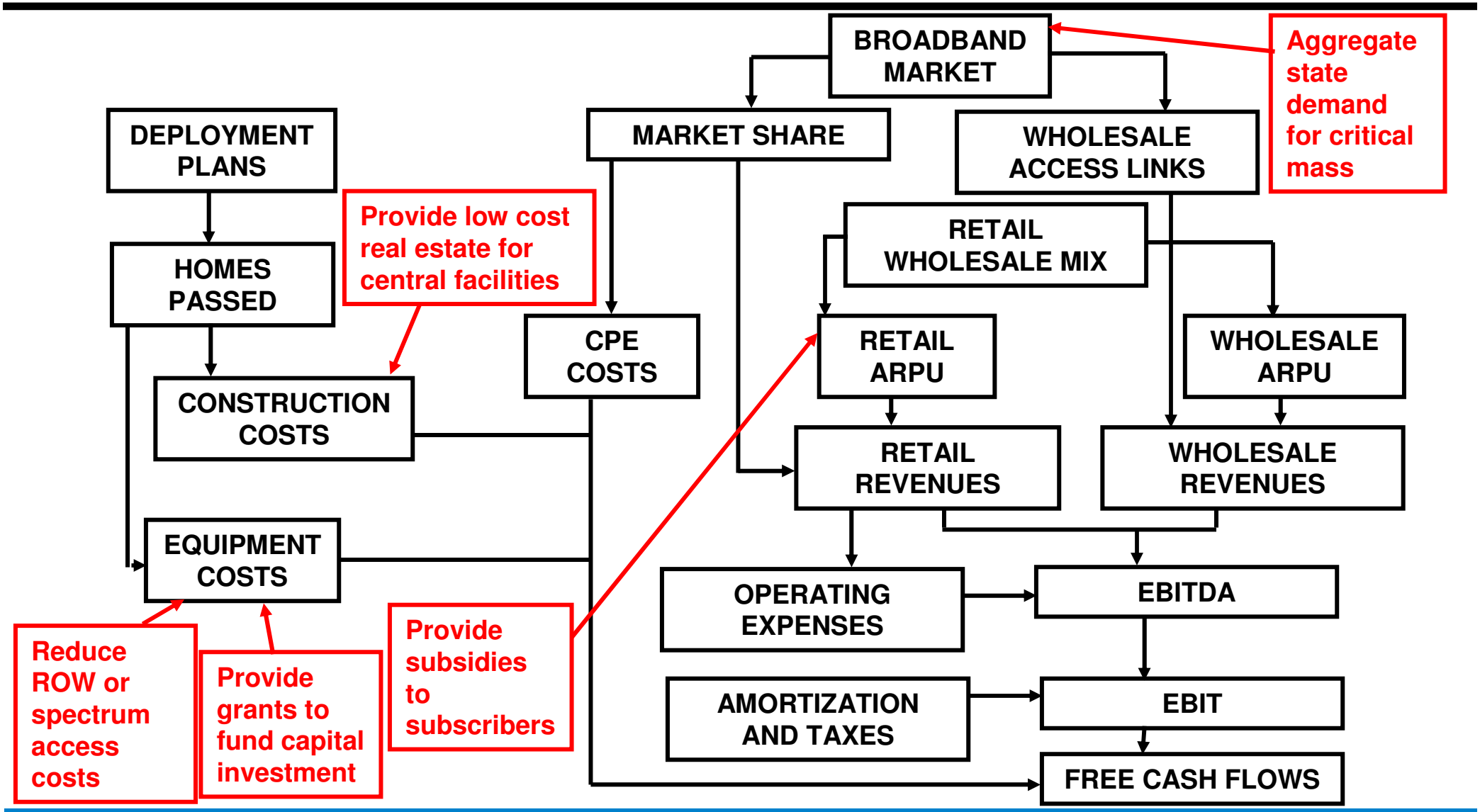
The demand challenge has to do with building critical mass and, consequently economies of scale



- Bigger company size does not necessarily lead to lower unit costs
- According to this, carriers which hold large market share in their served territories tend to exhibit lower unit costs
- As such, economies of scale of covered POPs are around 76%

Source: Merrill Lynch; analysis by the author

Government intervention can render a business case sustainable by taking several initiatives



Aggregate demand: the local government can become an anchor user to guarantee revenues at ramp-up phase

- The best way to stimulate the supply of broadband infrastructure without artificially intervening in the market is to “bundle demand”
- Pro-actively coordinate demand for wireless and/or broadband access from government administration, public safety, local schools and health care facilities in order to create an anchor tenant
- Negotiate a wholesale rate and long-term contract
- Define Service Level Agreements
- Create a flow of revenues that ease the economic pressure on the business case
- Organize groups of people (schools, communities,smes, etc…) at the grass-root level
- Establishment of a Broadband Expertise Centres to spread knowledge on broadband for organisations and institutions that do not have ICT as their core task
- Deploy broadband demonstration areas for consumers in libraries and conduct training

Subscriber subsidies need to be used sparingly

- Fiscal incentive: a reduction in local taxes to small and medium enterprises has been found to stimulate adoption in areas that can have an impact on economic output
- A subsidy targeted to economically-disadvantaged subscribers addresses the social inclusion problem (Universal Service)

Infrastructure consolidation should be allowed and encouraged to alleviate cost pressures on competing operators

- "The single biggest reason to adopt sharing is to lower the cost of deploying broadband networks to achieve widespread and affordable access… For developed countries, infrastructure sharing promises to play an important role in the move to FTTx access…"
- "Deploying mobile base stations on fibre backbone networks to reach rural areas may be uneconomic if each company builds its own network. Likewise, laying fibre to every home, building or street cabinet may be unattainable where operators act alone. Companies can, however, share some infrastructure but compete on services."(Source: What Do We Mean by 6 Degrees of Sharing? Discussion Paper for ITU GSR08, Feb. 2008)
- If Multiple broadband is not sustainable, sharing or consolidation may produce a broadband access "Utility"
  - Allows operators to capture economies of scale and reduce investor risk (lower costs)

    BUT

    Requires operators to share the lower costs with consumers (rate regulation? structural separation?)
  - Minimizes infrastructure competition

    WITHOUT

    Sacrificing retail application/service competition

There are several ways of affecting the cost side of the business case

- Reduce right of way or spectrum access costs
- Regulate backhaul costs, although states have little regulatory capacity to do so
- Provide grants for capital investment, particularly backhaul capex
- Stay away from using tax payer money to make loans (conflict between managing risk and preserving value of tax dollars)

Should Government Be the Risk-Taker of Last Resort? Maybe

- Subsidize incumbent telco/BB to upgrade to “utility”
- In greenfields, government could build (contracts) for the construction of universal access network
  - Strong competition for government contracts = lower initial costs
- Government can then auction the broadband infrastructure to highest (qualified) operator
  - Monopoly for wholesale-only/open access “utility”operator?
- Any “loss” is a one-time infrastructure subsidy (like building a highway and road system)

Example of self-funding broadband network

- Ontario County, NY non-profit entity is building a 180-mile, 144-strand fiber optic network The network, three rings strung along utility poles, will connect the towns of Victor, Canandaigua, Hopewell, Clifton Springs and Farmington, under s sharing principle
  - Public benefit to connect municipalities: Twelve strands will be dedicated toward use by local governments , sharing resources among public entities
  - Wholesale to private service providers, which the county believes will be motivated to bring broadband to rural areas once the cost of building the middle-mile fiber is taken out of the equation
- Longer term, the network will connect:
  - Area research centers, potentially even reaching the National Lambda Rail research network through its connection to Cornell University
  - More rural public agencies using the network to share data platforms used by government agencies in larger towns – tax databases and visual mapping applications
- Five service providers have already signed on to use the network, including two competitive local exchange carriers and three wireless operators: WavHost, Clarity Connect and Verizon Wireless. WiMax providers are evaluating the network as well.
- Much of the funding for the $7.5-million project – begun in late 2005 — was made possible thanks to a natural gas company, Empire State Pipeline, whose pipeline goes through Ontario. The county initially put up $2.5 million – part of which was a loan and part payment for use of the network – and secured a $5-million bond.

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In most countries, local governments play some role in broadband deployment

- In the US, there is a legal framework allowing municipalities to operate a telco in response to a failure of the private sector to deliver service: 66 municipalities are already operating fiber networks and over 40 are planning one
- In Sweden, 136 municipalities have fiber based networks
- In Germany, there are currently 25 city networks, some of them controlling 50% of the local market (e.g. Cologne, Hamburg)
- In the Netherlands, there are currently 16 municipal fiber projects covering most major cities (e.g. Amsterdam, Rotterdam, Almere)

However, there is no single business model driving municipal broadband networks

- Four business models have been identified
  - Closed network, whereby Municipality provides retail services
  - Wholesale to a single retail service provider
  - Wholesaler of transport to multiple retail service providers (open access)
  - Provider of dark fiber
- In the US, the 66 municipalities operating fiber networks do so in any of the first three models
- Similarly, in Sweden, municipalities either offer dark fiber (Stockholm, Vasteras) or offer services (Gavle)

First Risk: Municipal networks have the potential of recreating an access bottleneck (Sweden case)

- A key feature of the Swedish broadband policy was to provide government funding to stimulate broadband development Provide government funding of approximately 400 million Euros to foster broadband infrastructure development between 2000-5
- Funds were allocated at all levels of the network hierarchy
  - Subsidies at the access level for development of neighborhood, and household fiber
    - Tax incentives given to businesses and residential tax- payers who sign up for broadband services (key stimulus in a country where the marginal tax rate for the average taxpayer is 20%
    - 50% of the costs are deductible up to a maximum of 5000 SEK
  - Emphasize development of “open” or “operator neutral” regional and local networks within counties and municipalities
  - Support for the build-up of a national backbone to ensure future transmission capability
- While funding was provided to municipalities to deploy infrastructure in areas where infrastructure competition was not feasible, they are starting to behave as commercial entities
  - Deploying infrastructure in areas where competition is feasible
  - Refusing to provide dark fiber or access to their infrastructure
  - Becoming full service providers
  - Prices are not market driven

Second Risk: in several cases the municipalities are migrating from public to commercial service (German case)

- In Germany, city broadband carriers were deployed to serve densely populated areas of their home markets

Carrier	FTTB Deployment Focus
NetCologne (muni)	Cologne (55,000 buildings/110,000 homes)
	Aachen
M'net (muni)	Munich (10,000 buildings/110,000 homes)
	Augsburg (450 buildings/5000 homes)
Stadwerke (muni and RWE)	Norderstedt, parts of Hamburg, Schwerte

Source: City websites; WIK; Amsterdam website

- With these coverage, the city carriers would serve approximately 6% of the population of Germany (calculated as the population of each of cities metropolitan areas)
- As of May 2008, of the 70 city carriers launched in 1990s, approximately 25 remained as non-affiliated operators holding high DSL share in the local markets (e.g. M'net: 20% of Munich, NetCologne: 50% of Cologne, Hansenet: 50% of Hamburg)
- A large number were bought by Arcor, M'net and EWETel
- From a financial standpoint, some German municipalities post broadband investment in the parent's balance sheet to benefit from lower borrowing costs

Third risk: some municipal models experience difficulty in serving customers (US case)

- In the US, open networks are often not the result of a conscious choice but a legal obligation of certain state laws (Utah, Washington)
- Laws determining the municipalities' ability to compete as a telco vary from state to state, which determines that public telcos tend to cluster in only 28 states (e.g. Washington, Tennessee, Iowa, Georgia, Kentucky, Minnessota, Florida and Virginia)
- Sometimes the provider is owned by a consortium of municipalities
  - UTOPIA owned by a consortium of municipalities in Utah
  - Iron Range Community Fiber network in Minnesota
  - ECFiber in Vermont
- Sometimes the broadband network extends beyond the city limits, offering services in adjacent areas
- Open access networks seem to be running into trouble in a variety of ways:
  - Operating inefficiencies prevents them to show a positive financial profile
  - Customer provisioning is very cumbersome in a multi-provider system
  - Difficulty in managing the network and resolving from service problems
  - PON systems are less capable of accommodating open network collocation

The international experience allows us to determine the areas of opportunity and the risks attached to state intervention

		IS PROJECT SUSTAINABLE AND PROFITABLE?	
		YES	NO
IS GOVERNMENT INTERVENING?	YES	• Preemption of private investment (Germany, Switzerland, Netherlands)	• Alleviate the constraints of the business case to stimulate private investment • Re-creation of access bottlenecks (US) • Erosion of the public utility model (US, Sweden)
	NO	• Market addresses the need of public good	• Supplier of last resort

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Should State governments intervene in broadband and wireless deployment? Yes, but facilitating market forces not preempting them

- Coordinate with governments, communities, businesses, and operators to identify supply and demand conditions and tailor services to unmet needs
- Identify barriers to consumer adoption where broadband exists
- Identify areas where there is no broadband service
- Help establish a “business case” to deploy broadband