LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Fakultät für Betriebswirtschaft
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FTTX in rural Areas: Public Engagement for Infrastructure Provisioning

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How can public engagement deploy broadband access focusing rural areas?

Research Targets

Current Situation

- Broadband hardly available in rural areas
- High competition levels in cities with multiple access technologies
- Massive infrastructure investment programs, e.g.
  - USA: 7.2 billion US$ (~ 17 EUR/head)
  - EU: 1 billion EUR (~ 2 Eur/head)
  - Australia: 43 billion AU$ (~ 1.100 EUR/head)

- Currently 56 kBit/s defined as Universal Service according to European Framework
- Different technologies under survey
- Digital Divide widening
- Broadband acknowledged as important, but path to broadband not existent

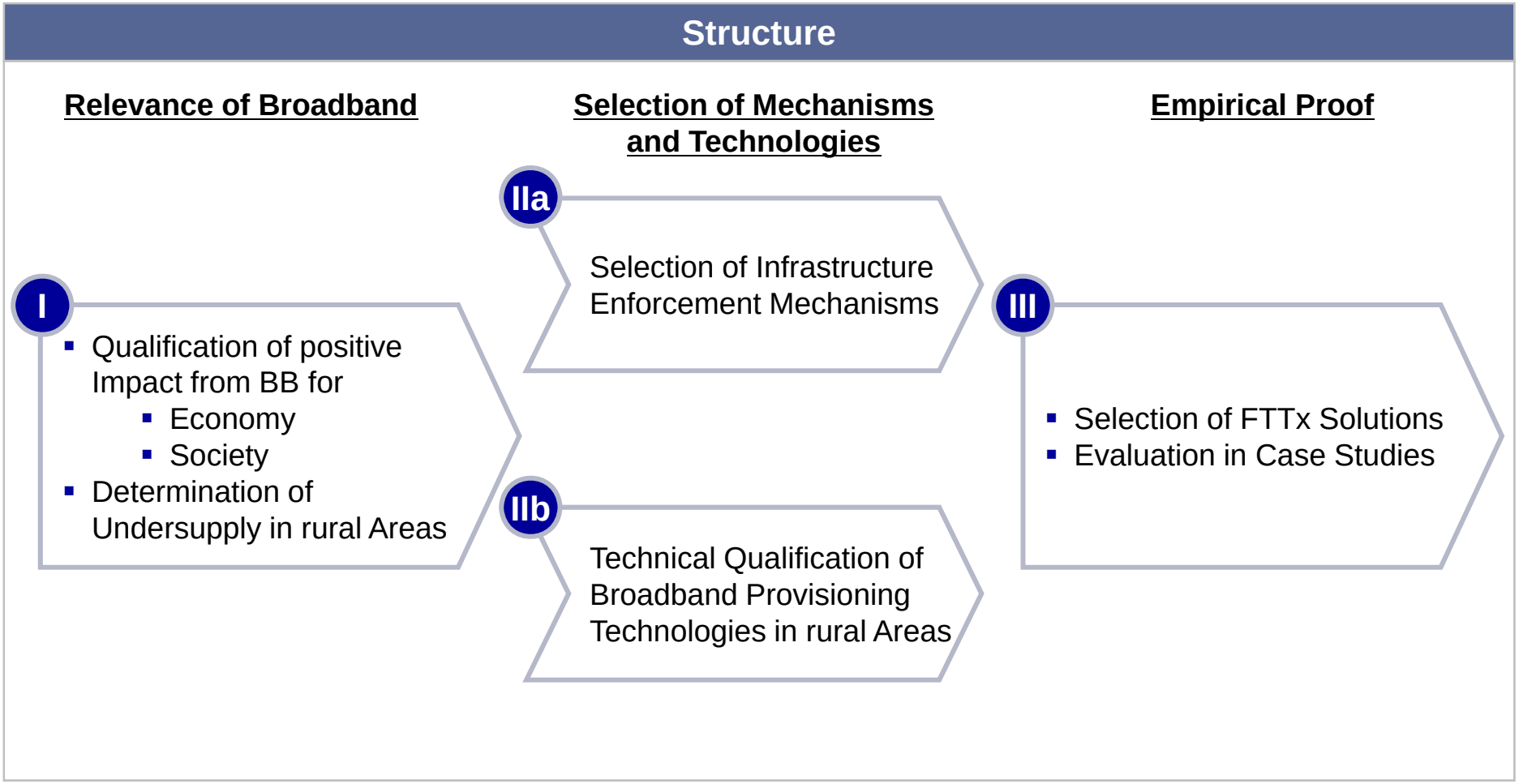
Additional Challenges

Level of Public Engagement

1. Is public engagement required for rural broadband at all?
2. If yes, what sort of engagement is most effective?
3. What kind of infrastructure does guarantee highest sustainability?

A twofold research approach combines outcomes from theoretical research towards technology and implementation mechanisms with market data.

Research Approach



Agenda

- Relevance of Broadband
- Selecting FTTx Technologies
- Mechanisms of Infrastructure Enforcement
- Case Studies
- Shortcomings and Recommendations for Action

Agenda

The current broadband definition has always been behind actual bandwidth demand, driven by supply and not demand.

Broadband Characteristics

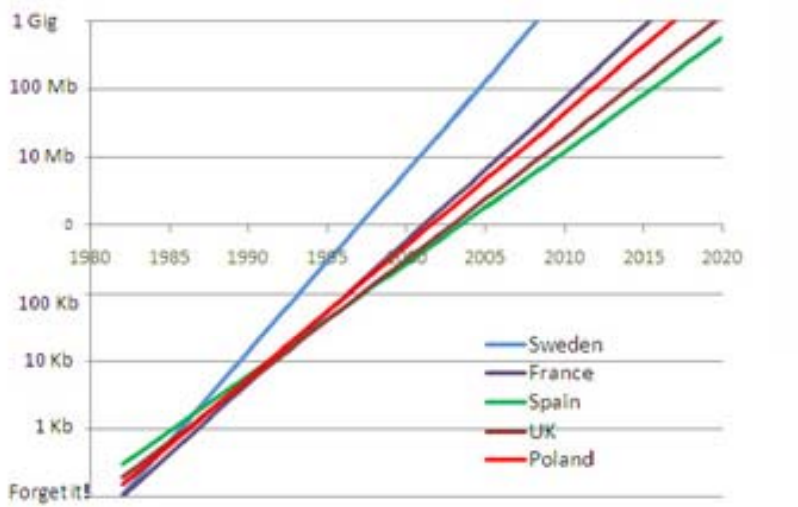
Defining Broadband

- Every Internet connection with a significantly higher performance than 56 kBit/s PSTN (old)
- ITU: 1.5 – 2.0 Mbit/s transmission capacity
- OECD: 256 kBit/s download capacity
- FCC (update):
  - First Generation Data: 200 – 768 kBit/s
  - Basic Broadband: 768 kBit/s – 1.5 Mbit/s
- Germany: 1.5 Mbit/s
- BMWi: 128 kBit/s
- Australian Broadband Guarantee: 512/128 kBit/s

- Bandwidth Supply drives Demand
- New Technologies not imaginable yet

How much Bandwidth is enough?

- Bandwidth Demand 1980 – 2020:



- Nielsen‘s Law
  - Supply drives demand; model derived from Gilder‘s Law
  - Bandwidth doubles every 21 months; e.g. UK matches assumption for the last ten years

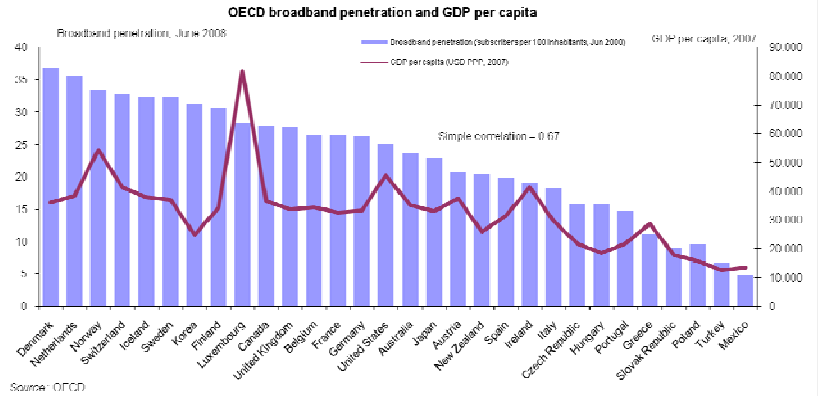
Source: Nielsen (1998); ITU (2003); Tanenbaum (2003); OECD (2009); BMWi (2009); Bogaert (2008)

Besides an accepted positive economic impact of broadband, no connection means not only being offline, it ends with being excluded from the society.

Relevance of Broadband

Driver for Economy and Society

I Economic Impact

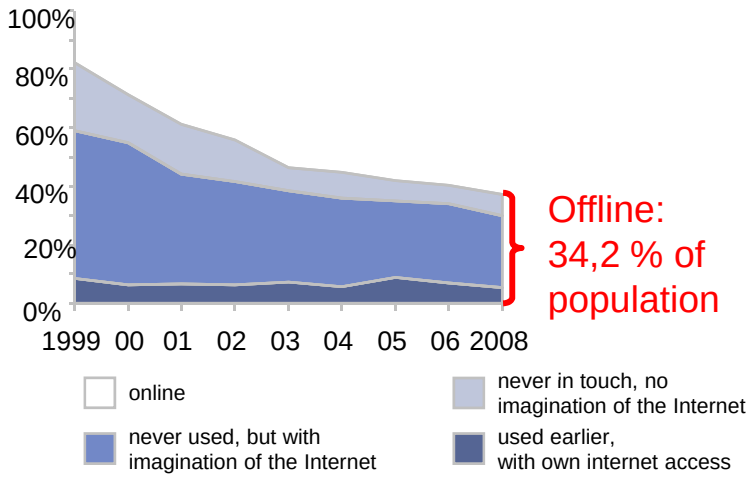


- Correlation BB penetration and GDP ~ 0.67
- "General Purpose Technology" acc. to OECD

II Social Impact

- Electronic communication as common form of social interaction (mail/messaging/portals/…)
- Information (products/prices/travel/…)

Digital Divide in Germany



- Digital Divide: Exclusion from Information Society
- 34 % are without access
- 22 % do not know the Internet at all

Interrelationship?
28 % live in rural areas

Source: OECD (2008); Gerhards/Mende (2008)

The absence of a consistent definition and lacking of public willingness to invest keeps rural areas currently offline.

Lacking Availability of Broadband 1/2

Broadband Definition

- ITU: ~ 1.5 – 2.0 Mbit/s
- OECD: > 256 kBit/s down
- FCC: 768k – 1.5 MBit/s

Universal Service

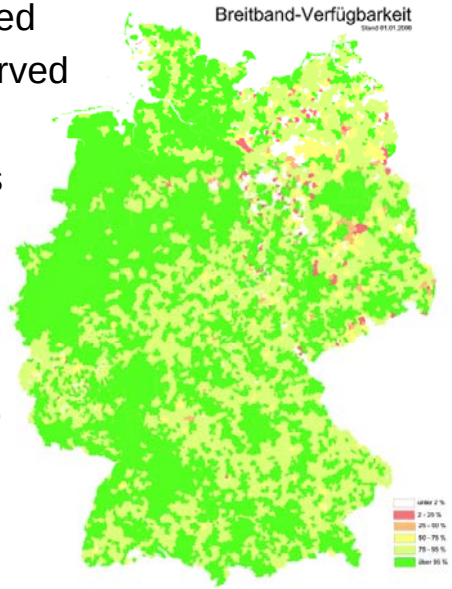
- European Union: 56kBit/s
- United States: telco services
- Switzerland: 600/100 kBit/s

Competition

- Cities/population dense areas
  - Parallel infrastructure
  - FTTH available in competition
- Rural areas
  - Single/no broadband provider

"Breitbandatlas" in Germany

- *Breitbandatlas* lists >1 mio people offline:
  - 713 municipalities not served
  - 632 municipalities underserved
- Broadband: ~ 128 kBit/s
- Increasing to 1 MBit/s reduces availability by another 8 % on national level
- „The German market is remarkable with a national DSL penetration rate of 17.3% but only 5.9% in rural areas."[1)]
- German Broadband Strategy:
  - 2010: 1 MBit/s area wide
  - 2014: 75 % of HH with +50 Mbit/s



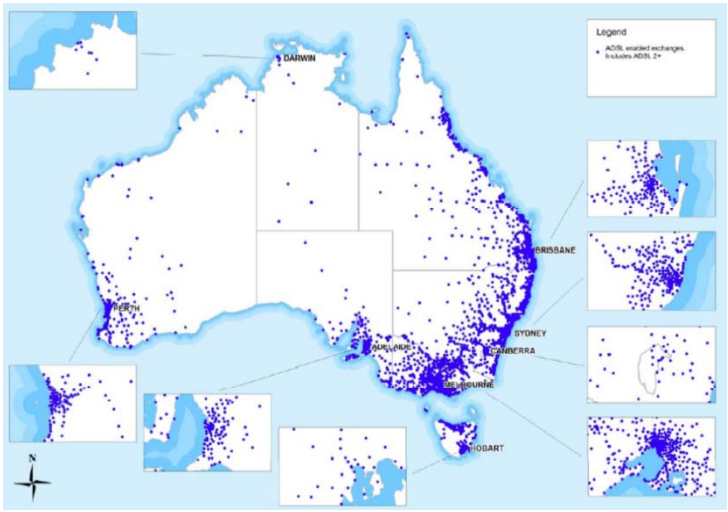
Investment of announced 150 mio. EUR will not suffice at all in order to fulfill these targets

Source: [1)] Idate (2007); BMWi (2008); BMWi (2009a)

In Australia, just 2.6 % of the entire population live in remote areas, but only 48% are within range for an broadband access with more than 1.5 MBit/s.

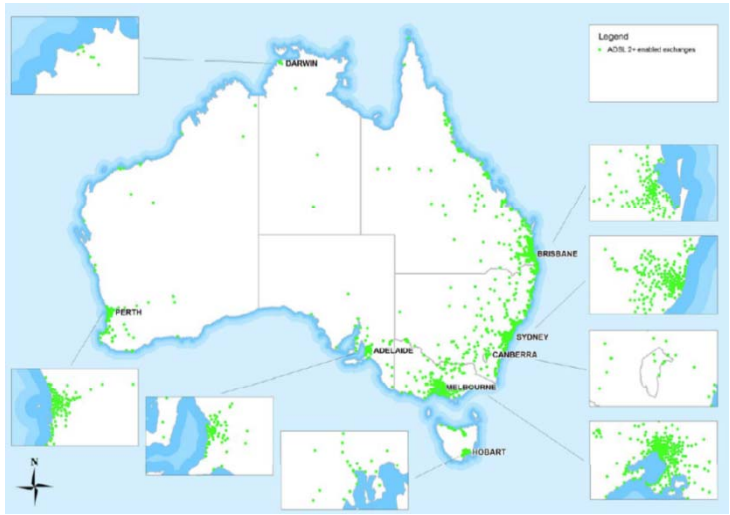
Lacking Availability of Broadband 2/2

ADSL Penetration Australia



- 2008: >45 % of exchanges without DSLAM
- Wireless only available in residential areas

ADSL2+ Penetration Australia



- 2008: only 48 % of entire population live within 1.5 km range of ADSL2+ enabled exchanges

Australian Government took immediate action in 2009 with National Broadband Network:

- Investment of AUD 43 billion over eight years, starting with 4.7 billion in the network
- Australian Broadband Guarantee for all Australian residents for metro-comparable services

Source: ACMA (2008); Australian Bureau of Statistics (2004); DBCDE (2009);

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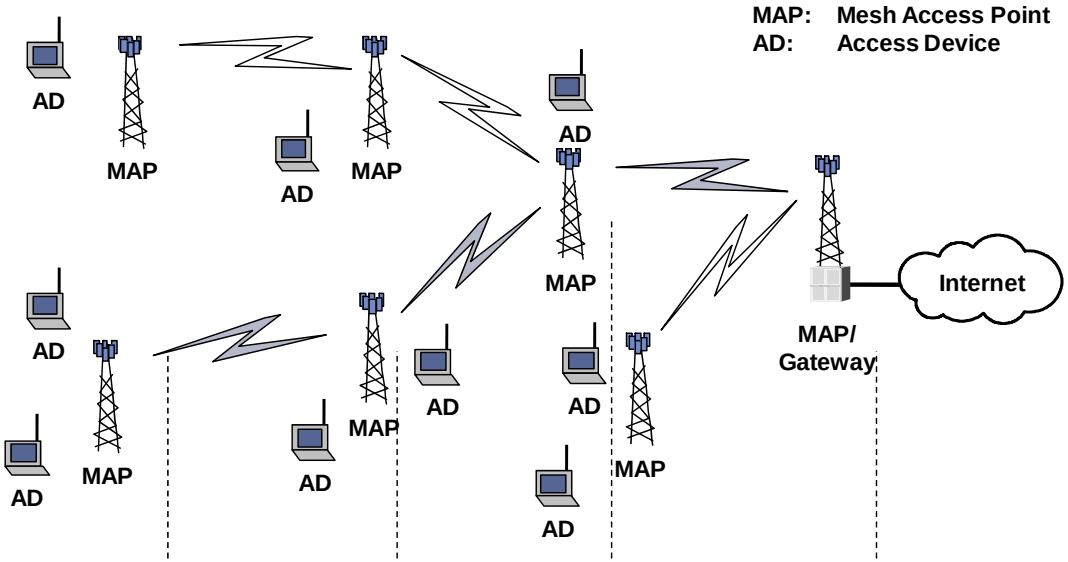
Wireless today is not sustainable for broadband access in rural areas and should be regarded as complementary solution for mobile devices only.

Wireless for rural Areas

Shared Medium Phenomenon



Example

Maximum Bandwidth	100 MBit/s	100 MBit/s	100 MBit/s	100 MBit/s	Backbone
Avg. shared Bandwidth	… x 1/2 ~ 2.5 MBit/s	1/2 x 1/3 x 1/3 ~ 5 MBit/s	1/2 x 1/3 ~ 16 MBit/s	1/2 ~ 50 MBit/s	

Wireless Broadband

- Shared Medium
  - Usage creates negative externalities to other users
  - Physical limitations in frequency spectrum
- Availability and Reach
  - Tradeoff between cell size and transmission power
- Quality
  - QoS below wireline
- Acceptance
  - Resistance of population due to health concerns

Digital Divide not solved via Digital Dividend

Source: Picot/Jondral/Elsner/Grove (forthcoming); Luo et al. (2008); Börnsen (2008); Vary/Lüders (2008);

FTTx Technologies are regarded as highly sustainable for deployment of broadband to rural areas.

Sustainability of wireless and wireline Technologies

Technology Shortcomings

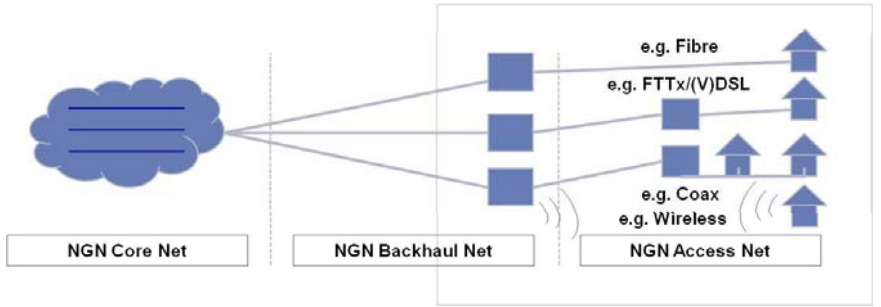
Wireline

- DSL suffers from too long LL in rural areas
- Coax not available in rural areas, and if, not upgraded to backchannel
- Fibre rollout is most expensive deployment, but cost can be reduced by upgrading later, beginning with FTTX alternatives

Wireless

- WLAN not for long range
- WiMax not relevant
- Satellite with latency problems
- UMTS not available in rural areas

Fibre Core Technology Deployment



- Core and backhaul network mandatory fibre
- FTTH preferred, where not applicable, use of existing infrastructure to connect customer
- Include WLL temporary overcoming delays
- Ensure upgradability

- FTTH deployments do not share bandwidth in a sense which imposes negative externalities on single users
- NGN P2P deployment in focus
- Usage of all technologies available to reduce time lags and connect as many people as possible

Source: Picot (2008a); Tanenbaum (2004)

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Hybrid approaches show highest potential in order to deploy broadband access to rural areas with regard to implementation speed and sustainability.

Infrastructure Enforcement Mechanisms

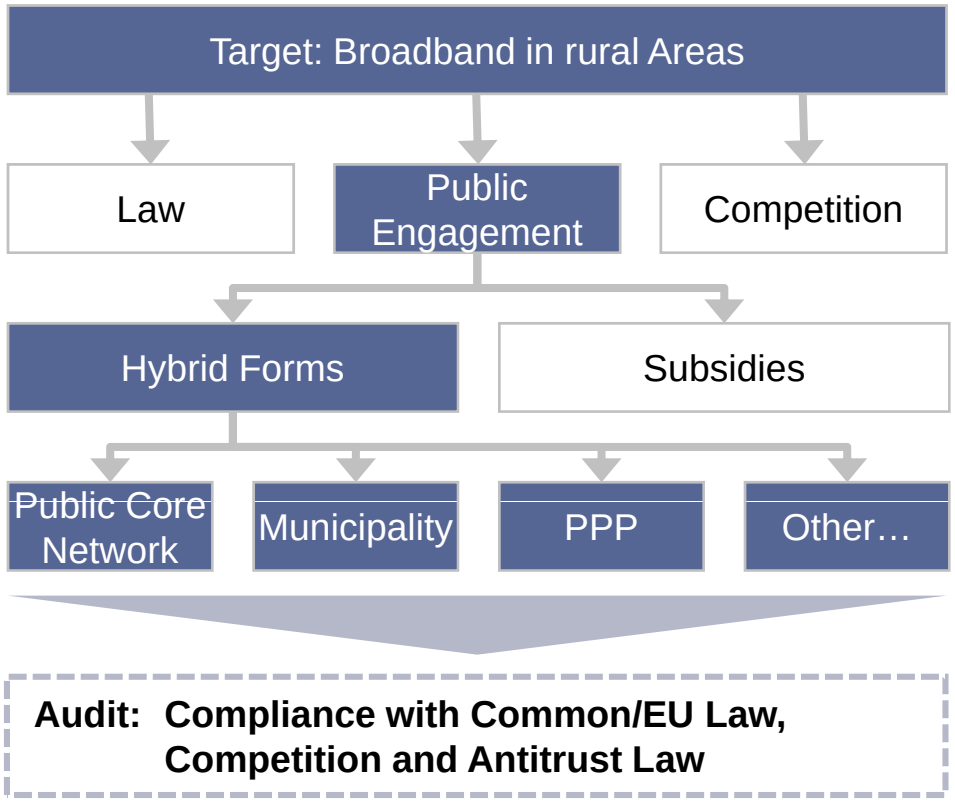
I	**Law/Legal Enforcement** ▪ Universal Service Standard ▪ Universal Service Obligation ▪ Functional Separation	▪ Common European Position? ▪ Duration? ▪ Resistance
II	**Independent** ▪ Business Case driven (Incumbent) ▪ Business Case driven (Competitor)	▪ Business Case not positive ▪ Resistance against sub national markets
III	**Subsidies** ▪ Direct as a fraction/percentage ▪ Indirect via consumer	▪ Market distortions? ▪ Fight for subsidies ▪ Competition Law
IV	**Hybrid** ▪ Public Private Partnership ▪ Publicly owned Networks	▪ Public Private Partnership ▪ Publicly owned core networks ▪ Publicly owned networks/network elements

Source: Laffont/Tirole (2000); Wernick (2007); EC (2007)

Hybrid Forms are suited best for rural areas due to highest implementation speed, availability of financing mechanisms and technological sustainability.

Hybrid Forms

Implementation Scheme



Major Reasons

I Speed of Implementation
- Competition not applicable
- Law/Subsidies correlate with legal intervention

II Financing
- Governmental guidance
- Combined with private business financing model

III Sustainability
- Law/Subsidies technology neutral
- Competition will not select sustainable technology

Source: Budäus (2004)

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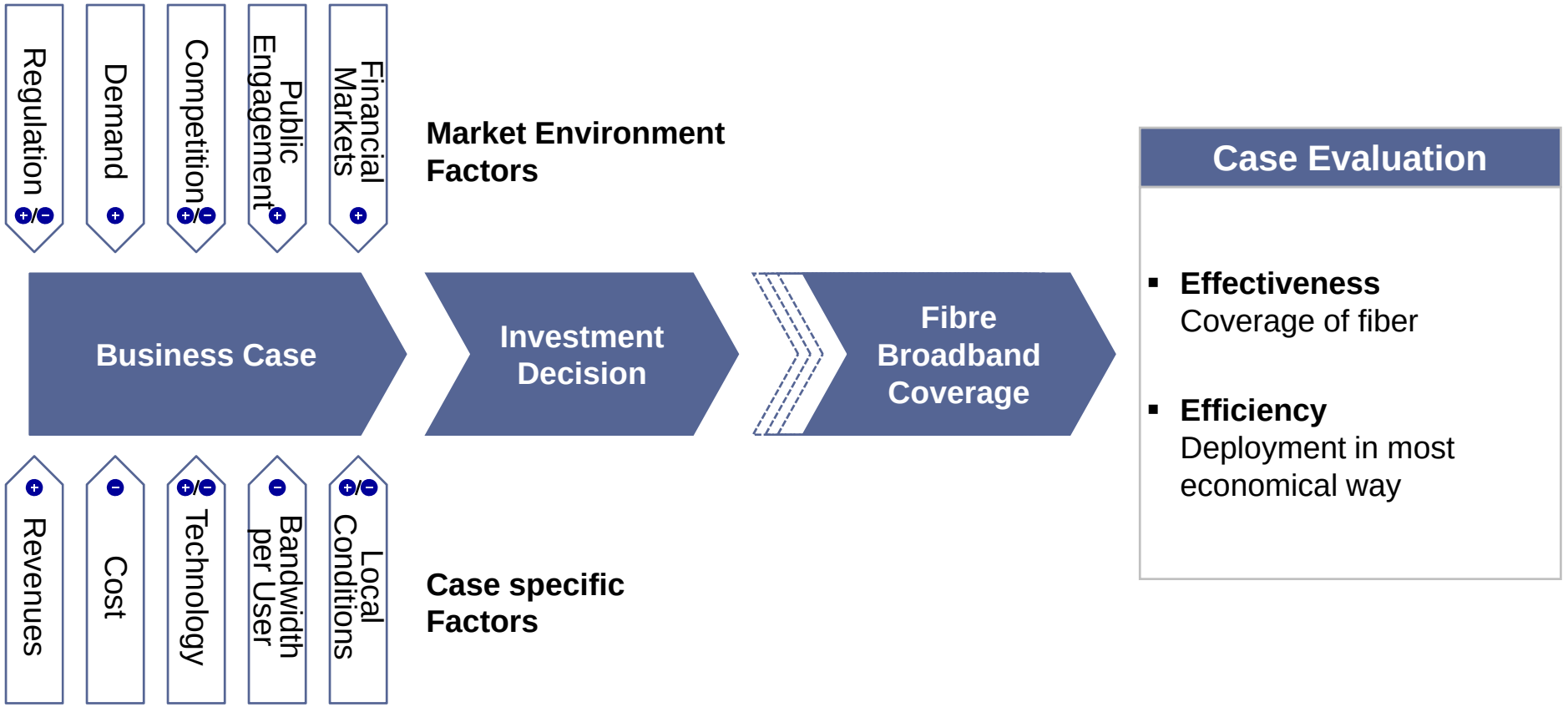
Existing FTTH business cases are analyzed from both dimensions, market environment and case specific factors.

Case Study Evaluation Methodology



Source: Holznagel/Deckers (2009); Lehr (2005);

In Schwerte, a public private partnership model was able to convince by customer satisfaction and additionally financially positive outcomes.

Case Example: Schwerte

RUHRPOWER elemente Stadtwerke Schwerte

Business Case Description

Macro Facts

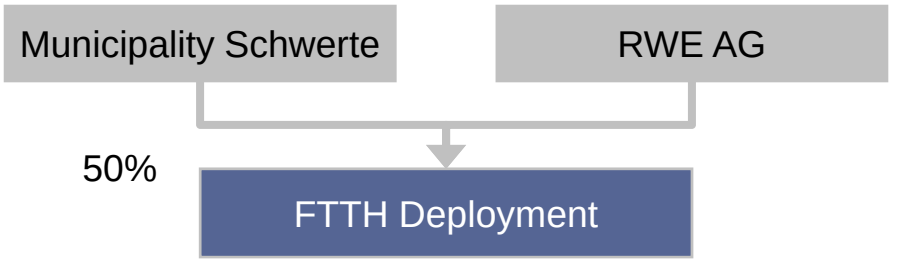
- Regulation: NRW municipal code privileges private competitors
- Demand: 50.000 inhabitants 24.000 HH, 11.000 buildings
- Competition: 1 cable operator
- Public Engagement: municipality
- Financial Markets: internal via RWE AG

Micro Facts

- Revenues: installation 42,01 €; monthly fee from 12,60 €
- Cost: connection 880 € - 2.250 €
- Technology: P2P FTTH
- Bandwidth/User: 100 MBit
- Coverage: > 50 % HH

Project Initiator: Stadtwerke Schwerte

Public Private Partnership



- Total CAPEX: € 25 mio.
- FTTH connection depreciation period: 20 years
- Triple Play offering for € 25/month (inc. VAT)
- Unique patented duct drilling procedure reducing digging costs significantly

Customer win rate connected houses:	85%
Customers connected until 7/2009:	3.597
Customer satisfaction:	high

Source: Stadtwerke Schwerte (2009); Grüll (2009); Visser (2008)

Creating a community owned network, Nuenen has established area wide FTTH coverage. This was possible by a € 800 subsidy per household.

Case Example: OnsNet Nuenen

Business Case Description

Macro Facts

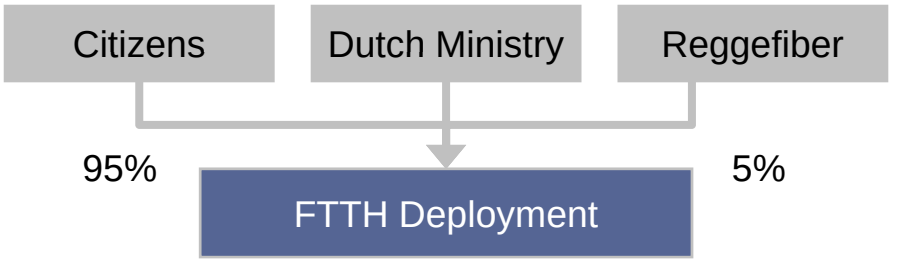
- Regulation: EU and Dutch telec. law
- Demand: 19.500 inhabitants, 8.500 HH, 7.500 buildings
- Competition: KPN, UPC
- Public Engagement: Ministry
- Financial Markets: community/bank/ investor/support/subsidy

Micro Facts

- Revenues: membership 20,00 €; monthly fee from 16,00 €
- Cost: connection ~ 2.100€
- Technology: P2P PON FTTH
- Bandwidth/User: 100 MBit
- Coverage: > 97% HH

Project Initiator: Entrepreneur Kees Rovers

Public Private Partnership



- Open network, operating since 2005
- Subsidy was € 800/HH
- 20 year loan contract
- Broadband Internet offered for 1 year for free
- Triple Play offering for 60 € /month (inc. VAT)

Connected houses: 97% initially, today 80%
Customers connected 2008: 7.500
Social experience closely related to project success

Source: Broadband Stakeholder Group (2008); OnsNet (2009); Rovers (2008); Idate (2008)

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Cases under survey proof public engagement as major driver for successfull broadband deployment projects in rural areas.

Results from Case Studies

1 Is public engagement required for rural broadband at all?
- High demand in rural areas
- Competition will not provide access

2 If yes, what sort of engagement is most effective?
- Hybrid forms show highest success rates
- Cases proof applicability and efficiency

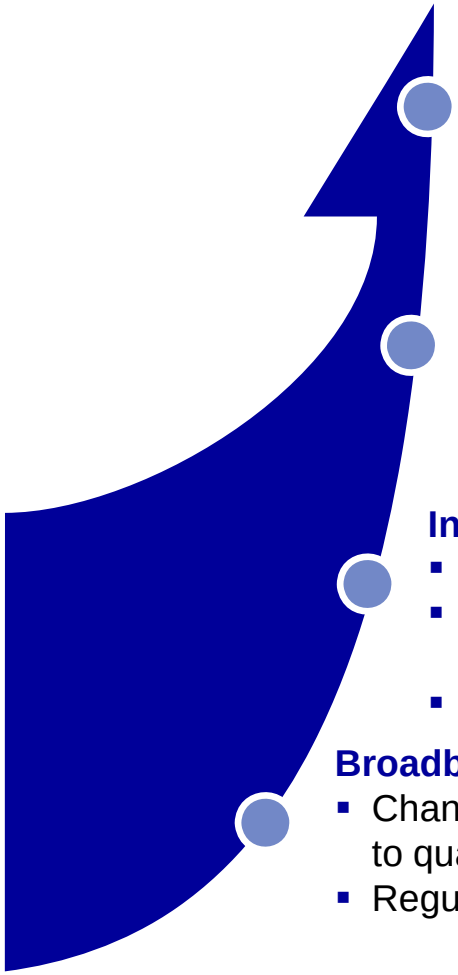
3 What kind of infrastructure does guarantee highest sustainability?
- FTTx with NGN core network are sustainable
- Wireless as complementary solution only

Success Factors

- **Public Engagement**
  Governmental aid/subsidy required
- **Entrepreneurship**
  Engagement of local activists
- **Local Characteristics**
  Integrate related local needs (communityTV, etc.)
- **Low Entry Barriers**
  Free testing period/opt-out option

Rollout of nationwide broadband infrastructures is of significant economic and social importance and should be engaged by public investment.

Conclusions and Outlook



Public Engagement
- Unconventional measures
- Joint initiatives
- Fast action
- Lowering barriers

Private Involvement
- Integration of financial risk
- Entrepreneurship
- Integration of local conditions

Influence of Side Effects
- Regulation/public law
- Interests of different stakeholders
- Mediation problems

Broadband Definition
- Changing from quantitative to qualitative determination
- Regular updates

„There is no reason to believe that network transmission speeds of 5 Mbps will not seem every bit as antiquated to us in five to ten years as 56 Kbps seems to us today.“[1)]

Source: [1)] Atkinson (2009)

THANK YOU