Economical analysis of Finnish national broadband action plan – Broadband to everyone

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***Abstract*—**Governments and local authorities all over the world have introduced a large number of initiatives to foster the development of broadband technologies. Finland is not an exception to this rule. According to Finnish broadband action plan, in 2015 nearly all Finns shall have an access to very high-speed service with a minimum download rate of 100 Mbps. The Ministry of Transport and Communications estimated that the commercial operators will achieve coverage of about 95 % of Finns primarily in build-up areas. But to reach the aim of 99 % of the networked households, public funding will be needed. The implementation of the action plan has already been started but there has been only limited discussion on the economical impacts of the publicly funded projects. The bottom-up method used in this paper revealed that economical gains do not justify the project but the motivation must be found from social aims like equal opportunities. The results of the study are also questioning the limited share of the national government in funding of the broadband projects on sparsely populated areas. The current funding model leaves too large responsibilities to other stakeholders of the project and this can jeopardize the implementation of the whole national broadband policy.

***Keywords*—** Broadband networks, Economical impact, Telecom policy.

I. Introduction

To date broadband services and fast Internet connections have been deployed unevenly with lower-cost, higher-income areas receiving access first. However, during the last years both economical and social arguments like equal opportunities have been stated to foster the introduction of broadband technology also to the sparsely populated areas. Given that broadband is largely provided by private companies that seek to maximize the number of subscribers and profits it is likely that market forces will continue to deprive low-income and rural areas of broadband access without government intervention.

In Finland the government released a new national action plan for strengthening the infrastructure for information society on December 2008 [5]. One of the main topics of the action plan was foster the deployment of next-generation broadband technology especially on remote areas.

The aim of the paper is to analyze the economic impacts of the Finnish national broadband initiative "Broadband to everyone 2015". The analysis focus on the growth of the gross domestic product (GDP) generated by the increased broadband penetration. In addition to that the roles of different stakeholder (including the national government, cities and municipalities, telecom operators and end-users) in funding of the initiative are discussed.

The structure of the study is as follows. Chapter 2 identifies both the common aims and stakeholders of public broadband policies. Special attention is paid to the positive economical effects of broadband, mainly economical growth and efficiency increases. In Chapter 3 the Finnish broadband initiative is shortly introduced. The introduction reveals that Finland has decided to use pilot project to test and develop the framework before starting the large scale implementation of the policy. Chapter 4 contains in-depth analysis of one pilot project. The case is a municipality wide implementation and the discussion does not include only the original plans but also the current results of operator's effort to attract new customers. The results of the case are generalized to the nation level in Chapter 5 and the final conclusions are made in Chapter 6.

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II. Aims of the Broadband Policies

A. Aims and Stakeholders

A large number of studies have found out that broadband connectivity has a positive impact on job creation, community retention, retail sales, and tax revenues (e.g. [6] and [14]) Based on these assumptions governments and local authorities both in developed and developing countries have created various kinds of broadband strategies and development programs. But what are the real effects of these initiatives? This question can be studied form many different perspectives but the following three categories are quite often used:

- Effects on economical effectiveness
- Effects on efficiency increase and
- Satisfaction effects

Economical effectiveness can be measured for example in terms of GDP growth, job creation or number of new firms or households attracted to the area. Similarly efficiency increases can mean higher productivity or lower costs in service delivery. Katz and Avilla [8] have stated that broadband technology can be a contributor to economic effectiveness and

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efficiency at several levels including the improvement of productivity resulting from the adoption of more efficient business processes, acceleration of innovation resulting from the introduction of new applications and services and a more efficient functional deployment of enterprises by maximizing their reach to labor pools or access to consumers.

Unlike effectiveness and efficiency, satisfaction is not an economic dimension but it contains social and personal aspects of broadband technology acceptance and deployment. Therefore satisfaction can take multiple forms and it can mean for example reaching some social or political aims or more satisfied citizens with new possibilities to work, educate or entertain themselves.

Implementation of broadband networks and information society in general is co-operation between numbers of stakeholders. Therefore Qiang [17] suggested that in addition to examine how broadband impacts the overall economy we should analyze impacts on following three additional level: individuals, firms, and communities. We agree with the idea of multi-level analysis, but we recommend a small modification to it. In broadband infrastructure the telecom operator's role requires special attention. Thus we think that the most important stakeholders in the broadband network projects are:

- National governments (national level)
- Local authorities (community level)
- Network operators
- End-users including both firms and individuals Effects on economical effectiveness,

The economics of broadband technology can and should be studied from all these level, but this paper focuses mainly to national and community levels.

B. Broadband penetration and GDP growth

There are an increasing number of studies about the effect of broadband penetration on the development of the GDP. Table I summarizes the findings of these studies.

TABLE I
RELATIONSHIP BETWEEN GDP GROWTH AND BROADBAND PENETRATION INCREASE IN EARLIER STUDIES

Analyzed country	Growth of GDP (for 1% increase in broadband penetration)	Study
Germany	0.026%	Katx et al. (2010) [7]
Latin American countries	0.018%	Katz and Avilla (2010) [8]
High penetration countries	0.023%	Koutrompis (2009) [10]
Medium penetration countries	0.014%	Koutrompis (2009) [10]
Low penetration countries	0.008%	Koutrompis (2009) [10]
120 countries	0.013%	Qiang (2009) [17]

Although these studies provide us with different estimates, the conclusion is always the same: broadband penetration increases GDP. The differences in the study results are very understandable because local characteristics make all cases unique. For example Crandall et al. [3] have pointed out that industrial structure of the region affects to the relationship between GDP and broadband penetration. Similarly Katz et al. [7] and Koutrompis [10] have suggested that economic impact of broadband is stronger in those cases reaching higher levels of penetration, mainly based on network effects and reaching the critical mass.

The recent economical crisis has again highlighted the importance of growth. Increased activity on the private sectors generates more tax revenues and is essential to stability of the economy. Although the increased tax revenues cannot be the ultimate goal of the broadband policy it is an important element in public funding and therefore they should be part of the economical analysis of public funded broadband projects.

C. Broadband and increased efficiency

For the national and local governments broadband infrastructure does not only mean growth of the private sector and increased tax income. In addition to that it offers to the public sector a possibility to efficiency increases and cost reductions.

For example, many developed countries are struggling with aging population and increasing healthcare costs. Thus, high expectations exist to the potential transformational impact of broadband connectivity on the effectiveness and efficiency of health care service delivery. Another interesting sector is education. Remote areas without critically needed qualified teachers can benefit from different kinds of broadband enabled distance learning services.

The same sectors seem to be the main interests also in developing world. Qiang [17] lists multiple examples in which developing countries expect public investments in broadband pay off especially through education and health care.

III. FINNISH BROADBAND ACTION PLAN

A. Broadband goals of the Action Plan

Finnish government released on December 2008 an ambiguous national action plan for strengthening the infrastructure for information society [5]. Enhancing the broadband infrastructure is an essential part of this plan and it has two distinct targets. First, by the end of 2010 all Finnish citizens, businesses and public administration bodies should have access to basic broadband services with a minimum download rate of 1 Mbps at a reasonable price in their permanent place of residence. Second, by the end of 2015 the entire country will be covered by the next generation broadband networks. Then next generation connections with 100 Mbps symmetric speeds should be available to almost every Finn (99 % of the population) in their permanent place of residence. In this paper only the second aim – access to 100 Mbps next-generation access network - and its economical effects are discussed.

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B. Supporting Core Networks to Rural Areas

The common regulatory trend in most developed countries has been deregulation and decreased governmental interference. So, is there a need for any government action or does the market do an adequate job of producing and distributing broadband services? These questions divide opinions and there are both supporters and opponents of a proactive national broadband policy (see for example [1] for more detailed discussion).

In Finland the Ministry of Transport and Communications decided to use partial involvement policy. The Ministry estimated that the commercial operators will build the next-generation broadband networks to urban areas and community centers. These commercial networks will cover about 95 % of Finns, and the government will not interfere the development of those networks. But to reach the aimed 99 % coverage, public funding will be used to offer high speed connections to the remaining 130 000 rural households. Therefore the Ministry developed a public-private partnership model in which end users, operators and public organizations together fund the broadband networks to areas with a very low population density.

The policy divides the network to two parts: the core and the subscriber networks. The telecom operators and public organizations together are responsible for implementing the required core network. End users instead are responsible for the costs of the subscriber network or "the last mile". Because in rural areas the distances between the user and the core network point of presence can be long the policy limits the user paid access network to 2 kilometers.

Originally the ministry estimated that the total cost of the core network is about 200 M€. The operators' share of the core network costs is at least 34 per cent. The remaining 66 per cent is public funding and it comes from the following sources: the government 66 M€, European Regional Development Fund 25 M€, cities and municipalities 40 M€). The share of the city or the municipality is 8, 22 or 33 per cent of the total core network cost and its share depends on its current economical condition estimated by the Ministry. There has been some discussion about the real implementation cost of the project and the plans made by regional councils suggest that the total cost is closer to 400 M€.

C. Pilot projects

The Ministry wanted to test the new broadband policy with pilot projects. Originally the Ministry planed to have about 5 pilots [12] but later 10 projects were selected and the total budget for them was 15.6 M€ [13]. Based on the Finish regulatory authority's (Ficora's) market analysis the European Commission notified the pilot measures in December 2009. After that the regional councils started an open tender process for pilot cases and they selected the most economically advantageous offer among those presented by the operators.

Out of ten pilot projects only seven actually started. In two cases there were no offers made by the operators and in one case the municipality cancelled the whole project. Due the administrative delays the actual implementations were started finally in summer 2010.

IV. Case: Pertunmaa Pilot Project

A. Introduction to Pertumaa pilot project

Pertunmaa is a small municipality with some 2000 people in Southern Savo, Finland. Pertunmaa has been very active in implementing the national broadband action plan and its project Petun kuitu (Pertu's fiber in English) was selected as one of the national pilot projects. Local authorities and regional council together designed the original structure of the core network (see Fig. 1).

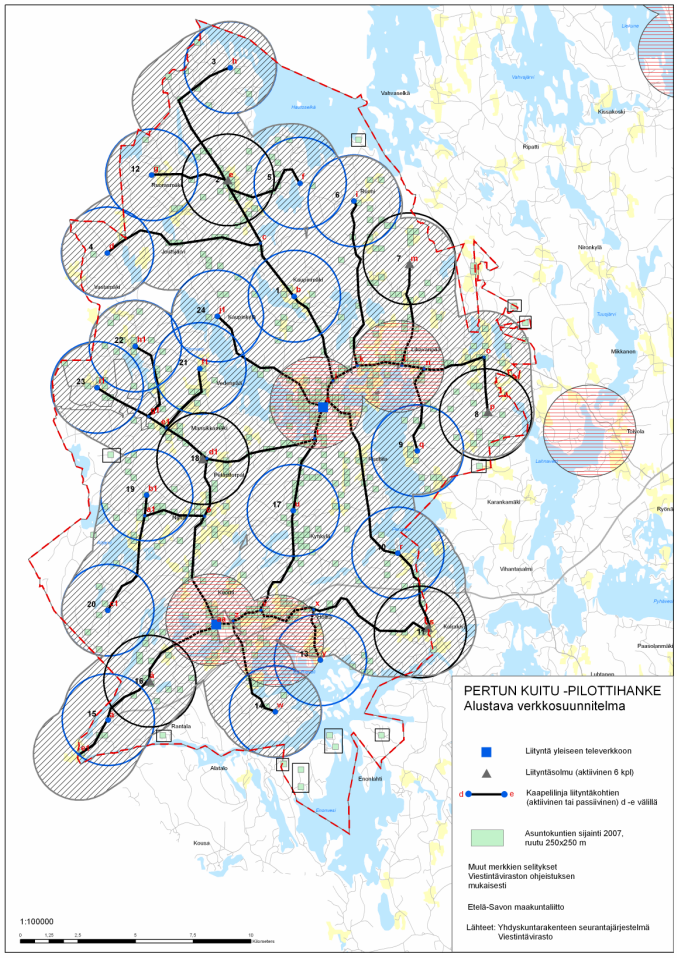

Fig. 1 Original plan for Pertunmaa pilot case [18]

According to this plan the total distance of the core network was estimated be 146 km and it will cover practically the whole municipality [18]. The plan also reveals that the Ministry has excluded two areas (shaded with red color) from the public funding. According to the Ministry´s calculations in these areas the fast broadband services will be available no later than 2015 on commercial bases and therefore no public funding can be used on those areas. On the publicly funded area there are about 560 potential customers and the total cost of the core network was estimated to be 1.4 M€ [18].

In a public tender process three operators made an offer and

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the price of the winning offer was about 1.3 M€ and the shares of the public funding are: municipality 0.3 M€, operator 0.4 M€ and EU 0.6 M€. The share of the municipality can be placed into the perspective when compared against the figures in Table II.

TABLE II
PERTUNMAA'S FINANCIAL FIGURES 2009 - 2011. [16]

	2009	2010e	2011e	
Tax income (€)	4 800 000	4 600 000	4 800 000	4
Investments (€)	1 200 000	700 000	1 200 000	7
Municipality debt (€ / citizen)	2 262	2 082	2 428	1

These numbers highlights the high priority of broadband project in Pertunmaa. The core network will be a quarter of the all investments of the municipality in 2011 and to be able to fund it the municipality must take new loans.

B. Current status of the project

The actual construction of the network started in summer 2010 and the network will be fully implemented no later than December 2011. Parallel to the implementation the operator has done a lot of marketing to attract customers to their network. Although the operator has taken part to different kinds of municipality meetings and local gathering the main marketing method is based on face-to-face sales. Table 3 gives some information about the marketing efforts and closed deals.

TABLE III
PERTUNMAA'S MARKETING STATISTICS [2]

	Total	Per centage
Number of potential customers	560	100 %
Contacted customers	296	53 %
Number of closed deals	123	22 %

So far the company has contacted a bit more than a half of the potential customers on the supported area. Currently 22% of the households have decided to connect to the network but the number is expected to increase when the remaining potential customers will be contacted. However, the customers contacted so far are more favorable to broadband services because they include all those customers who contacted the operator themselves. Therefore the operator has estimated that the finally close to 30 per cent of the households are expected to be connected. [11]. With the average Finnish household size of 2.1, the penetration rate will thus be about 14 % (14 connections per 100 inhabitants).

The two main reasons not to buy the broadband service are the lack of need and the high installation fee. The lack of need is typical in a case where the customer does not even have a computer and therefore there is no need for broadband connection either. Most of these customers are retired people with a relatively high age. [11]. Installation fee covers the costs to connect a subscriber to the core network. The fee without VAT varies from 1 028 € which includes 100 m connection to the core network up to 10 000 € if the distance to the core network is 2 km or more. However, the experiences so far suggest that only in extremely seldom cases the customer is ready to pay more than 3 000 € for the fiber to the home connection (FTTH). [11]

In the closed deals the average installation fee has been 1 430 € and the cumulative worth of the subscriber network has been 176 000 €. [2]. With the estimated 30 per cent penetration rate the worth of the subscriber network is likely to be about 240 000 €. In this calculation the subscriber connections are implemented only to the households subscribing the service.

V. DISCUSSION

A. Economical Impact of the Project

Although there are differences between rural areas in Finland some economical estimates of the whole national broadband initiative can be made based on Pertunmaa case. First, if Pertunmaa's expected 30 % household acceptance rate will be achieved in all supported rural areas the project will generate about 39 000 new broadband households. This will mean all in all about 2.5 % increase in the current number of broadband connections and 0.7 % increase in the penetration rate per 100 inhabitants.

Compared to the current broadband penetration rate in Finland 30.5% [4] Pertunmaa's estimated penetration rate of 14 % is remarkably lower. This finding is suggesting that the project is clearly opening new but not yet equal opportunities to the rural areas. Further studies are still needed to analyze the reasons behind the lower acceptance of broadband technology but the role of higher installation fees cannot be underestimated.

Earlier studies reported in Section 2.2 have found GDB growth from 0.008 % to 0.026 % for each 1 % increase in broadband penetration rate. With these low and high-end estimates and 171 billion Euros national GDP for Finland [20] the GDP increase will be in the range of 10 – 30 M€/year. Bearing in mind the revised estimated costs of the project (400 M€ without the subscriber network) the GDP increase is not adequate to justify the use of public funding to the project but the motivation must be found from social aims like equal opportunities.

B. Effect on Tax Revenue

The broadband initiative has both direct and indirect effects on tax revenue. Direct effects are related to the actual implementation and operation of the network and indirect effects are the outcomes of increased economical activity. Broadband projects can generate more tax income in two main forms: income tax and value added tax (VAT). In Finland income tax is gathered both from companies and individuals and it includes both local and national components. VAT instead is a national tax.

The public funding of the network implementation is based

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on actual costs. Therefore the direct income tax revenue from the network operator can be considered to be equal to zero. Naturally the use of subcontractors can change the situation to some extent but for the simplicity reasons they are neglected here. People working in the project naturally generate income tax revenue. Unfortunately there is very little information available to calculate the total amount of it. Very rough estimates based on the original national estimate (200 M€), general cost structure and average income tax level in Finland is in the range of 15 – 30 M€. We want to point out however that further studies are needed to reach a better estimate.

Direct VAT revenues are much easier to estimate and they are generated both at the implementation and operation phases of the network. The VAT revenues during the both phases can be calculated as follows.

Analysis of the Pertunmaa project suggests that the cost of the subscriber network is about 18 % of the cost of the core network. Although public funding is not available to the subscriber network it is a vital part of the project. Total cost structure of the project and VAT revenues for the national level are shown in Table IV both for the original and revised estimates. Bearing in mind that the share of government funding in the original estimate is 66 M€ direct VAT revenue of the implementation phase covers already more than 80% of the governmental funding.

TABLE IV
ESTIMATED COSTS AND DIRECT VAT REVENUE FROM THE IMPLEMENTATION OF THE BROADBAND INFRASTRUCTURE

	Original estimate	Revised estimate
Cost of the core network	200	400
Cost of the subscriber network	36	72
Total cost	236	472
Value added tax (23 %)	54	109

The VAT revenue from the monthly fees can be estimated as follows. With an average 30 €/month service fee, 23 per cent tax rate and the estimated 39 000 new broadband customers, the generated VAT revenue of the broadband connections is about 3.2 M€/year.

The direct VAT revenue figures alone points out that the payback time for the government's initial 66 M€ investment can be expected to be really short. If we still count the higher income tax revenues and the indirect positive effects of the GDP growth, the national government is actually likely to collect more tax money than investing in this project. Although this is positive from the government's point of view the current funding model leaves too large responsibilities to other stakeholders of the project. If the government lets municipalities, telecom operators and end-users to pay the whole bill for the equal opportunities, it can jeopardize the implementation of the whole broadband initiative.

C. Effects to regional development

We have some earlier examples indicating that technical development has not only opened new possibilities but also created new threats to the rural areas. A good example is the retail sector. Rural communities have experience retail sales losses both when companies initiated their mail order operations as well as when the discount mass merchandise stores were introduced [19]. Similarly Kilkenny [9] found out that innovations that reduce cost of transportation from rural locations may also reduce transport cost to rural areas. Although this opens possibilities to local communities it can also have negative effect on region development in the form of concentration and usage of economies of scale.

What are the results of broadband technology to the local economy is still unknown. The key question here is: Are the broadband users only consumers of information or are they also producers? The minimal transportation cost of data networks can offer a possibility to create new services to the whole world but simultaneously it brings the new remotely produced services available to the local customers. As a result of this some areas can benefit from broadband technology by creating new revenue streams to the region. In some other areas the broadband technology can decrease the local business activity and money flows out from the area in the electrical format. Further studies are needed to analyze both positive and negative effects of broadband networks to the economies of the sparsely populated areas.

VI. CONCLUSION AND FURTHER STUDIES

Finland has decided to be one of the forerunners of applying FTTH technology in sparsely populated areas. The national action plan has set the framework for the co-operation between public and private sector in rural broadband services.

Although there are a large number of reasons for proactive broadband policies the main goals are typically either economical (growth or efficiency gains) or social. The results of this paper have pointed out that the expected economical growth (measured in terms of GDP) generated by this project is not large enough to justify the use of the public funding. Therefore the justification of the project must be found from the social dimensions like equal opportunities and bridging the digital divide.

The Ministry has used a slogan: "Nation-wide, reliable and fast communication networks are in an ever increasing role when analyzing the competitiveness of regions, accessibility and equal opportunities of people." [15]

But who should pay for fulfilling this social goal. The results of this paper are suggesting that although the government is funding broadband projects increased VAT tax income is compensating its investments. This leaves a heavy burden to other stakeholders: cities and municipalities, network operators and finally to end-users. Recent developments like some cities and municipalities withdrawals from the project and reduced interest among operators are indicating that the without stronger governmental funding the action plan cannot be implemented in a full scale. This would mean that the original aim: Broadband to everyone will transform to broadband to someone.

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