Doctoral Program in Management and Business Administration

SYNOPSIS

of the doctoral dissertation of

Gergely Kis

Evaluation of the Government's Involvement in Digital Telecommunication Network Development in Hungary

Supervisor:

dr. András Nemeslaki
associate professor

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E-business Research Center

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I. RESEARCH PRELIMINARIES AND TOPIC JUSTIFICATION

The ever-increasing demand for information and communication technology (ICT) services and the resulting shift in consumer habits and business expectations have drawn considerable attention to the importance of the digital telecommunication network in the national economy. The development of the (information) society, along with its inevitable reliance on ICT services, is fundamentally determined by innovations in broadband infrastructure, particularly by the availability of broadband access to the digital telecommunication network.

I.1. Topic justification

As early as 2002, András Kápolnai, András Nemeslaki and Róbert Pataki pointed out in their book that "the network economy is becoming far more deeply embedded into society than its business scope would suggest" (Kápolnai, et al., 2002), however, considering the four prerequisites of the new economy, this development would be unthinkable if the quantitative infrastructure condition were not met. The availability of the digital telecommunications network is the key to all ICT services; obviously there is no ICT-based 'network economy' if the network is lacking or outdated.

The development of the information society is propelled by the information and communication technology sector, which is owned mostly by economic actors. However, the cooperation and interactions of the government and the public sector are essential for its evolvement. "The convergence of the telecommunications, information technology and media industries is an increasingly prevalent, markedly expanding development. The importance of this phenomenon is underlined by the fact that the technologies of the three sectors

are commonly referred to as 'information society technologies' (IST)." (Abos, et al., 2007) Information society consists of three basic components:

1) availability of technological devices and access to digital telecommunication networks fundamental to their use (infrastructure);
2) people with technology skills (digital literacy);
3) content (digital information).

The development of the information society is contingent on the combination and harmonization of all three factors; the simultaneous presence of the three elements is necessary for permanent progress.

In my doctoral dissertation I explore the first of the three factors listed above, namely the accessibility of technological devices, in particular the development of the digital telecommunication network crucial to their utilization. The first component of the issue – the accessibility of technological devices – is shaped by research groups specializing in this field, as well as by the competition among multi-national corporations providing products and services to the global market. The use of these devices can be promoted by government actions. My primary focus, however, is the second component of the essential infrastructure: the development of the digital telecommunication network, including the various aspects of the basic infrastructure required for information and communication services:

- The nature and extent of the digital divide;
- Its causes and origins;
- Tools available to bridge the gap;
- Methods previously used in Hungary to overcome market failures. [1]

[1] There can be several types of market failures affecting broadband access, but the symptoms of these failures can be summarized in three factors: coverage (who has access); market structure (is the market monopolistic or free); prices (prices associated with individual service levels in regional breakdown or international comparison).

This dissertation is structured according to the following cause-and-effect framework:

1) The digital divide is a real phenomenon, and it impedes economic progress (competitiveness) and social equality on the long run.
2) Poor information and communication technology infrastructure is a key factor among the causes of the digital divide. Without adequate infrastructure it is impossible to combat digital illiteracy.
3) Based on the institutional economics approach, this dissertation seeks to assess and portray the progression of Hungary's digital telecommunication ecosystem and the effectiveness of the role of government institutions that are in charge of overseeing and promoting its development. I examine the concepts and approaches that the relevant public administration organs have applied to address and mitigate the shortages in the basic digital telecommunication infrastructure, and evaluate their success rates.

I.2. Research goals and main research question

This dissertation explores the framework, results and effects of government measures aimed at the development of digital broadband telecommunications. Based on an analysis of actual implemented programs, I offer suggestions as to what government intervention tools would be most beneficial in the future to maximize the outcome. Little has been published on the subject in Hungary, and the majority of the literature focuses on regulatory issues. This is due to the fact that quantitative studies geared towards the production of basic data have been rare in the field, and a significant percentage of the data remains unpublished. In terms of potential intervention tools, this study focuses primarily on strategies that could be effective in ensuring universal high-speed Internet access, therefore other topics will be discussed only minimally, for example within the topic of spectrum management the present study deals only with frequency allocation in

terms of its relevance for the core and aggregation network and for providing broadband Internet services in the access network.

My central research question concerns the extent to which government intervention efforts have been effective in terms of stimulating infrastructure development and establishing a regulatory framework that shapes the environment for investment projects.

RQ: What are the impacts of publicly funded broadband infrastructure investments in Hungary, and what areas of digital telecommunication network development call for government participation in order to ensure a more balanced progress of all regions in the country?

II. RESEARCH METHODOLOGY

The topic and methodology of this research study deviate from the mainstream of the Doctoral School of Management and Business Administration at Corvinus University, Budapest. Owing to the complex nature of the topic, I applied a different organizational principle instead of the traditional structure generally used at the Doctoral School[2]. I introduced the research question in the introduction, and I dedicate separate chapters to the individual hypotheses. The relevant literature is presented prior to the discussion of each hypothesis in several chapters rather than as a separate unit in the initial half of the study. In the case of (desk) research on several topics, I rely mainly on material published by regulatory authorities and international organizations in the domain of digital telecommunications, due to the fact that the analysis of a number of hypotheses required the examination of primary literature, to which academic resources[3] can provide guidelines only.

[2] A typical dissertation written at the Doctoral School has the following structure: a survey of relevant theoretical literature, formulation of a research question and hypotheses, presentation of the methodology and the research, and finally hypothesis testing.

[3] e.g. Information Economics and Policy, Telecommunications Policy.

Each hypothesis is based on an individual research project, of which there is a total of six. I used both quantitative and qualitative research methodologies to test the hypotheses, always applying the relevant tools for the actual topic under study. The research methods, along with explanations to justify their application, are also discussed prior to each individual research.

In the course of the research for hypothesis testing I formulated practical recommendations for development policy in the field of digital telecommunication networks.

III. RESULTS OF THE DISSERTATION

The study provides an analysis of publicly funded broadband infrastructure investments in Hungary and the impact of government intervention in digital telecommunication network upgrades. In an effort to ensure a geographically more balanced digital telecommunication network development, I formulated six hypotheses, which proved to be correct in the course of the investigation. These theses could provide guidance for the design of pertinent government development concepts.

III.1. Results of the hypothesis testing

The ***first thesis*** revealed that geographical differentiation continued to intensify among subregions in the development of the Hungarian digital telecommunication network over the period between 2003 and 2008. Subregions developing at an above-average rate in terms of the comprehensive ICT availability index established for this study are generally in the Great Plains area as well as in Central Hungary, while those growing more slowly than the average tend to be in Northern Hungary and in Southern Transdanubia. Overall, the gap increased between the most and least developed subregions in terms of ICT availability. This regional imbalance should be tackled by a targeted ICT development policy aimed at boosting subregions that lag behind the average.

The ***second thesis*** demonstrated that the definition of broadband varies from country to country, and revealed that the principle of technology neutrality applied mandatorily in EU regulatory processes complicates government-funded infrastructure projects by counteracting the push for the universal use of fiber optic technology, the optimal long-term choice for Wide Area Network (WAN) projects. It is primarily up to the EU policy makers to solve this problem, however, by keeping access network and wide area network upgrades apart, it is possible to define quality parameters that ensure that WANs are deployed using exclusively fiber optic technologies in the future. Although optical fiber cannot be considered technology neutral, it is the only up-to-date technology for aggregation network upgrades, and also the least subject to constraints due to limited financial resources. In certain categories and keeping proportionality in mind, projects for well-defined public purposes should be exempt from the principle of technology neutrality, for example to maintain public safety, to promote social or regional cohesion, or to foster competition, protecting the long-term interests of consumers. The research designed to test the second hypothesis also revealed that the conflict between the definition I applied and the principle was not the only source of controversy, as in many cases proposals resulted in technical solutions that would not stand the test of time: the lack of precise definitions regarding the principle of universal access and its mandatory adoption, which impedes legal enforcement[4], caused a bigger problem than the principle of neutrality itself. Contrary to the intended political objectives, public resources were used primarily for the construction of private networks.

The **third thesis** provides guidelines for development policy: in a liberalized communications market public resources allocated for digital telecommunication network infrastructure upgrades should only be used for WAN networks provided

[4] There had been no legal precedent for the enforcement of open access regulations by the time this dissertation was completed (September 2010).

that the infrastructure to be constructed (1) is not an alternative system next to an existing network or (2) aims to alleviate the shortage of existing fiber capacities. In all other cases the only role of the government is to apply regulatory tools in the WAN market to foster competition. In the current EU recommendations (e.g. NGA) government intervention tools focus on the access network. Therefore, government intervention is considered desirable only in certain geographic areas under the following conditions:

1) Basic broadband is not yet available, and no broadband construction is planned by private investors for the near future[5].
2) A next generation access network is not available and not planned to be built or scheduled for operation in the near future.
3) A broadband access network is available but certain user groups fail to receive appropriate service, or the cost is not affordable due to the lack of competition, or the quality of the service is poor, with no improvement in sight.

The above prerequisites are indisputable, however, WANs are not systematically classified in a separate category, which is a big mistake in my opinion. EU directives provide no specific rules regarding the infrastructure-versus service-based competition among digital telecommunication networks; consequently, Hungarian policy makers are in charge of establishing the basic guidelines aimed at fostering competition and to create an appropriate regulatory environment in line with the directives of the EU. The thesis I formulate provides a framework for this process in the field of wide area networks.

The following factors have to be considered in the case of government aid:

a) Does the intervention have a well-defined objective of common interest, i.e., is the proposed aid aimed at alleviating market failure or is it aimed at achieving another objective?

[5] The term ‘near future’ refers to a three-year period.

b) Is the aid well designed to serve the objective of common interest? Do the following issues receive adequate consideration:
    i. Is government aid an appropriate policy instrument, or are there other, more efficient tools?
    ii. Does the aid have a stimulating effect, i.e. does it alter the behavior of businesses?
    iii. Is the subsidy measure proportional, i.e. could the same effect be achieved with less aid?
c) Are the distortions of competition and their effects on trade limited, ensuring an overall positive balance?

Currently there are no EU guidelines pertaining to government aid to support the construction of wide area networks, however, the European Union's aid approval practices include regional development programs simultaneously addressing WAN and access network investments. The analysis points out the key elements of the mandatory (functional) separation of the wholesale and retail segments relevant for regulatory authorities.

The **fourth thesis** underlines that if the government aims to stimulate infrastructure-based competition, its primary task is to ensure regulated access to wide area networks, which are essential infrastructure, in an effort to promote the development of ICT infrastructure. Given the high costs and extremely slow returns on investments, it makes no sense to augment the wide area network connecting municipalities by an alternative infrastructure: due to economic considerations, it is desirable to ensure that by providing access, WANs create competition among market participants. In my proposed plan I suggest that open access is a principle which allows the competition requirement to be met. The EU framework of regulatory instruments did not adopt the principle of open access as a standard that can be required by authorities. In line with the EU regulatory framework currently in effect, an authority can impose ex ante price control only

on the wholesale prices of operators with significant market power in the market of terminating and trunk segments of leased lines. The National Communications Authority (NHH) has not identified any operators with significant market power (SMP) within the trunk segment, and with respect to a service provider identified as an SMP operator (Magyar Telecom), a 'retail minus' price control was implemented, which has not significantly facilitated the participation of other market players. In contrast to the prevalent regulatory practices in Hungary, the regulation of infrastructure leasing and other miscellaneous services provided through the trunk network, i.e. the dark fiber market, would be equally important for wholesale service partners. Unless market-driven wide area network deployment did reach all locations, public resources need to be used to roll out the basic infrastructure – in this case, ensuring open access is mandatory according to the regulatory principles of the EU. This framework will likely change as a result of the publication of the commission recommendation on regulated access to Next Generation Access Networks (NGA) in September, 2010, which opens the door to potential innovations in Hungary, as well.

The analysis supporting the **fifth thesis** proved that while approving a total of five government-funded broadband infrastructure development projects, economic policy makers envisioned a publicly operated digital telecommunication infrastructure that is extremely limited in both scope and effect, serving as a make-do solution. Up until 2009, economic policy makers refused to spend public resources on broadband infrastructure upgrades in a deregulated digital telecommunication market unless they assumed the lack of broadband internet access in municipalities based on the NUTS5 (later LAU2) classification. Investments funded from public resources in an effort to make up for the shortage were aimed at providing broadband internet access in municipalities where there was no private sector business case to deploy the necessary infrastructure. WAN and access network developments were not addressed separately in terms of development policy, consequently, policy

makers tended to ignore the issue whether community-based operation would be desirable in certain areas of the digital telecommunication network. The study revealed that government-funded basic infrastructure investments can not only offset the slower growth of lagging subregions in terms of ICT availability (and usage), but they are able to even accelerate them, generating a faster growth compared with other subregions. However, upon completion, the newly deployed publicly funded access network in the locations under investigation was not suitable for the very purpose it was built for: broadband Internet access. The prices of aggregate access are high and unregulated owing to insufficient control by authorities; local governments struggle to find operators that are willing to provide services in less profitable areas. Cable television (HFC) networks built previously with community resources have been bootstrapped and advanced since 2007 (the majority of them became bi-directional, i.e. suitable for Internet services, as well); nevertheless, the problem demonstrates how a community program promoting broadband Internet access turned into a private cable network development project. We cannot afford this to happen again in the future.

Finally, the **sixth thesis** provided evidence that in Hungary's wholesale broadband market the regulatory tools alone have (so far) been insufficient to ensure that by taking advantage of wholesale services that require more extensive networks (e.g. by local loop unbundling), an essential factor for sustainable competition, local exchange carriers can build a significant retail subscriber base of their own. It is a major problem that the co-locations determined in the reference offers of incumbent service providers can typically be accessed exclusively by the incumbent's own network, with the networks of other service providers requiring significant upgrades to potentially provide reasonable alternatives. There are a few exceptions, though, especially local exchanges in Budapest, but the problem is prevalent even in major cities across the country. For the purpose of interconnection, alternative providers are required to request network access from incumbents, generally in the form of leased lines. Access

seekers claim that the prices are set very high, and, as discussed earlier, price regulation is poor. Interconnecting – and taking advantage of the existing local loop – is generally not profitable at such a high price level, even if an operator already has a relatively large clientele of subscribers (basically by using the nationwide IP bit stream provided by the incumbent) in an exchange area serviced by a given MDF. Access networks built for loop sharing are currently being dismantled in Hungary. Theoretically, the problem could have also been addressed by regulatory tools, primarily by a more detailed (geographically focused) segmentation of the leased line trunk segments market, or, more generally, by the ex ante regulation of trunk segments, by rationalizing the collocation process and significantly cutting collocation costs. By now, the prevalence of xDSL-based broadband access has declined in locations with up-to-date cable TV networks, along with the importance of local loop unbundling; consequently, it is difficult to project the actual market results of the otherwise desirable regulatory reform.

The Digital Agenda of the European Union requires all member states to present and implement their own broadband Internet strategies by 2012. The individual strategies have to demonstrate detailed action plans aimed at meeting the Internet coverage goals and determine the role of program (Key Action 8).

Many countries all over the world commit themselves in various national broadband strategies to ensure Internet connectivity at a certain speed, for a certain percentage of the population within a certain time. Obviously, the due dates, the coverage areas and the technical parameters vary on a broad scale, just like the motivating force behind the programs. The differences can be attributed to country-specific geographic conditions, settlement structure, digital literacy of the population, as well as political power or the lack thereof. France, Germany, the United Kingdom, Sweden, Finland, Portugal, Estonia, etc. presented their area-specific programs in line with the Digital Agenda in late 2008 and early 2009 for the most part, and the implementation process is also underway in those

countries. In order for Hungary to progress, evidence presented in the study suggests that the country is in need of a (broad-spectrum) ICT strategy that takes into account, within reasonable limits, the expected trends in consumer demand over the next 10-15 years when envisioning community-funded digital telecommunication infrastructure upgrades and establishing the corresponding regulatory policy.

III.2. Development policy recommendations

Based on the analysis of the individual hypotheses, I compiled a summary of best practices in development policy that should be continued, and I identified the areas in need of improvement

Best practices

1) *Acknowledging the importance of government intervention in areas where there is no convincing business case for broadband infrastructure investments.* Despite the critical comments during the course of the analyses, it should not be ignored that the government has allocated resources for broadband infrastructure developments since 2003. In Poland, for example, there was no aid of any type available for such purposes during this time until 2008.
2) *Building a broadband coverage map.* In terms of the lack of a digital network infrastructure cadaster, the fact that the preparatory work for broadband infrastructure development proposals, including the Economic Development Operational Program GOP 3.1.1, was increasingly based on research revealing actual data rather than providers' self-reported information was a major step in 2007. Obviously, the lack of such data in the prior period could be presented from a critical perspective, however, countries significantly more developed than Hungary did not have a precise inventory at that time, either (for example, Germany did not decide to create such a record until February, 2009, as part of its strategy

design). Looking forward, it would be beneficial to create the most comprehensive and precise record possible to reflect the status of Hungary's digital telecommunication network infrastructure.

3) *Successful receipt of the allocated funds for proposals approved for EU funding.* It is true that funding was insufficient for nationwide broadband coverage reaching all locations in Hungary, however, those projects that were approved for funding did manage to receive payments, and none of them were required to return any financial aid.

Identification of areas in need of improvement

1) *Inappropriate management of investment (development) tax benefits*. Even though the utilization of this tool causes revenue loss to the government, the development of broadband infrastructure has a stimulating effect on the economy, which is likely to pay off generously as a result of indirect effects.
2) *Lack of cooperation between the ministry in charge of the field and the regulatory authority.* This problem surfaced during the preparation of broadband infrastructure development proposals, and, following the completion of the investment, in the insufficient monitoring of conditions specified in the proposal (which frequently precludes the implementation of the principle of open access). In addition, confusion arising from vague definitions also need to be mentioned here, as it is up to the authorities to provide precise definitions of concepts relevant to the development policy makers. Collaboration between the two organizations is essential in the course of proactive and preventive regulatory interventions, as well. It is the duty of the political leadership to ensure an effective cooperation.
3) *Lack of distinction between wide area networks and access networks in terms of development strategies.* In the case of WAN deployment, it is clear that deviating from the deployment of optical fiber lines is allowed only under exceptional circumstances in order to optimize durability (e.g.

when it is difficult to cross a river in the absence of a bridge). Nevertheless, technology-neutral designs specified for speed and optical, speed-independent models can equally be considered as far as the requirements are concerned. The increasing variety of competing wired and wireless technologies in the access network projects that the government's primary duty will be to meet their bandwidth demand with respect to the wide area network. This proves to be the case despite the fact that the costs involved in the building of the access network are significantly higher. Due to the capacity of the wide area network to create a monopoly, regulatory processes (market analysis) have to pay special attention to ensuring open access.

4) *Poor management of limited resources, including roads, sidewalks, poles and easements.* Spectrum management is the primary responsibility of the National Media and Infocommunications Authority, however, the organization has little say in determining the location of substructures and superstructures (except during the approval process, which basically involves the mere requirement of declaring the planned location). Competitive bidding processes or auctions to grant monopoly concessions should receive special attention. The majority of roads and sidewalks are owned by the central or local governments. Optimally, no roads should be built or upgraded without the construction of an open-access cable duct made available for digital telecommunication networks (owing to the mandatory regulation, they are currently being rolled out along expressways, however, the utilization of the deployed optical cables is not satisfactory). It is important to keep in mind that appropriate local government mandates can gradually guarantee that developers in digital telecommunication networks use only publicly owned cable conduits to deploy communication lines. This would not only secure revenues for local governments, but it would also help to avoid the frequent breaking

and patching of streets and sidewalks by various developers. At the same time, there needs to be some kind of regulation that prevents local governments from selling publicly owned telecommunication infrastructure to ease their financial problems. Considering that 70-90% of the infrastructure deployment costs (depending on geographic conditions) go toward the installation of cable ducts, the expenses of investors could also be reduced considerably, which would further stimulate competition. In the case of superstructures, on the other hand, owners of poles could be subject to regulations if excessively high rental rates hamper investments. Digital telecommunication network upgrades in multi-family buildings also require regulation, or, as demonstrated by the Swedish example, an industrial agreement with builders. Currently the chances of second, third or additional operators to enter multi-unit buildings are minimal, partly because the infrastructure within the building is not accessible, and partly because building superintendents tend not to support new entrants.

5) *Lack of comprehensive development programs*. The five broadband infrastructure development proposals carried out so far in Hungary have not been embedded in comprehensive development programs, and neither have the two planned but unexecuted development concepts (GOP 3.1.2 and the National Digital Public Utility Infrastructure). Developing the broadband infrastructure is a powerful driving force in itself, but if a program also focuses on the development of services related to the infrastructure with particular attention to their utilization, indicators measuring the outcome will likely show significantly more positive results. Certain demand boosters have been have been around for a while, (e.g. programs to fight digital illiteracy, or creation of public access points, etc.), however, these do not address the comprehensive development of a region.

6) *Insufficient wholesale market regulations and failure to force carriers to offer wholesale services.* It is essential to mandate that a broader range of carriers allow wholesale access with price control, and to require functional separation (forcing operators to separate wholesale and retail activities, also in terms of accounting) where applicable. This was not incorporated in the NHH resolution DH-664-178/2005, however, resolution DH-26600-26/2007 published in 2007 calls for an almost functional separation, but the control function as well as compliance monitoring with respect to the fundamental details are yet to be taken up. In its recommendation on regulated access to Next Generation Access Networks, the European Union strongly supports joint investment agreements in the area of Next Generation Networks and allows operators to set lower prices for access to fiber optic subscriber loops in return for long-term contracts or quantitative considerations.
7) *Failure of the government to serve as a strategic investor.* The last time Hungary had a conscious industrial policy regarding telecommunications was in the 80s. Since then, none of the administrations have made an effort to promote Hungary to achieve a global leading position in at least one segment of the sector given the country's engagement in ICT development activity. R&D activities in the ICT field are conducted exclusively by multinational corporations in Hungary, and there is no government-initiated industrial policy that would coordinate these efforts.

My recommendations for development policy were formulated on the basis of hypothesis testing and professional experiences in the field. The conversion of the new European regulatory framework into Hungarian legislation will undoubtedly provide opportunities for modifications; however, these will affect only certain aspects of the issues discussed above. A supportive political, social and economic environment is necessary for broadband infrastructure developments to demonstrate their potential to be the engines of progress.

NGN/NGA issues have shown that regulations are worthless unless the infrastructure is or will be in place. However, there will likely be no business case for these types of developments at the current rollout costs except in major cities. As a result, the digital divide is expected to persist for an extended period of time considering the digital telecommunication infrastructure, and it important to consider which types of services need to be supported by the government, keeping in mind that the changes will also have negative impacts on certain sectors. The government's participation needs to be constantly examined and reevaluated.

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