

UDC 621.39:33

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*Institute of Next Generation Networks, Zilina, Slovakia***DRAFT FOR METHODOLOGY FOR COMPARING THE STATE
OF ICT INFRASTRUCTURE IN DEVELOPED WORLDWIDE COUNTRIES
BASED ON KNOWLEDGE OF TREND**

Rapid development of information and communication technologies supported by research in optics has brought sufficient bandwidth for new broadband services and applications. Broadband access and services in nowadays, are seen as crucial for business development and overall country prosperity. Thanks to that, the Internet is not only a service, but it is a platform, which has a significant impact on all areas of society. Customers' interest is focused on particular multimedia services with an attractive content which have, however, various demands for bandwidth. These services include IPTV, along with innovative television services, video conferencing services, online virtual environments, health care services and new web 3D services. Implementation of research results and deployment of broadband accesses in countries of Organization for Economic Co-operation and Development (OECD) is different despite expectations. Analyzing the implementation steps of broadband access in the countries with the highest penetration of broadband accesses gives an opportunity to the other countries to utilize appropriate know-how for their own benefit and growth with respect to their own specific market environment.

Keyword: *information and communication technologies, broadband services, Internet.*

Introduction

Permanent yearly increase in number of broadband connections and increasing of broadband penetration (see Fig. 1) [1] points out to growing communication needs of society and positive trend of using the broadband services. With the increase in broadband penetration, the service providers are more oriented on quality of provided bandwidth. Today, we can say without doubt that the future of new innovation services will not be based on copper infrastructure. Estimated bandwidth for future customers in 2018 will be somewhere around 1 Gbit/s [2].

These expectations corresponds with the trend of gradual grow in optical access infrastructure.

It is important to see that for this increase in popularity are currently interactive multimedia services as virtual distributed environments (online gaming portals, social networks, sharing music and movie files, communication in communities), television services (IPTV, Stereoscopic Television, Free viewpoint video), videoconferencing, medical services (Electronic health card, localization and so on specified by the European Commission) and extending the use of Web services environments such as Web 2.0, respectively Web 3D in future.

Current average market share out of optical access infrastructure to all types of broadband accesses in

OECD countries is 9% and is growing annually. In countries such as Japan and Korea, this share is 51% respectively 46% according to data available in June 2009 [3].

Implementation of research results and deployment of broadband accesses in OECD countries is different despite expectations.

Analyzing the implementation steps of broadband access in the countries with the highest penetration of broadband accesses gives an opportunity to the other countries to utilize appropriate know-how for their own benefit and growth with respect to their own specific market environment. This should be also supported by this new methodology of ICT infrastructure evaluation, which will be based on comparative analysis of those key criteria.

The major factors influencing broadband services usage are following: broadband penetration, utilization of broadband services in the households, socio-economic aspects, the geographic relief of the country, offers of services/access speeds and cost of access/services. In generally, we speak about the groups of technological, financial and social criteria.

The purpose of the introduction is to present background information for the work with literature references, and possibly to outline the organization of the paper.

The following we will describe the methodology.

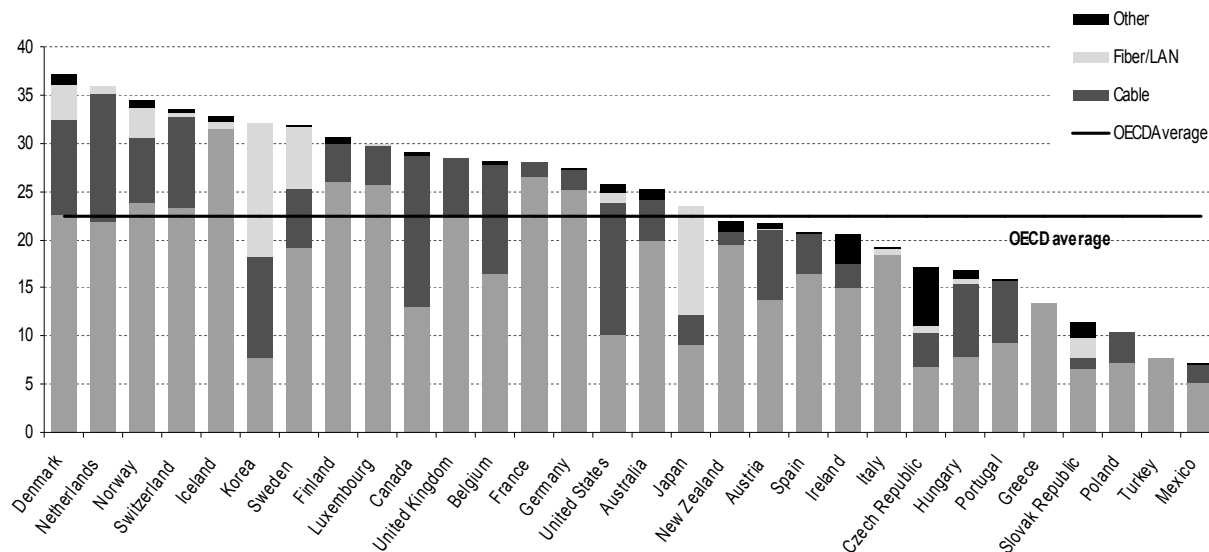


Fig. 1. The number of broadband users per 100 inhabitants, June 2009

1. Draft for methodology

An important part of presented methodology is the choice of evaluation criteria and weighted coefficients. Proposal criteria have been carried out with maximum respect for the objectivity of the evaluation process. The choice of appropriate criteria is important in terms of its substitutability in the process of growth in broadband penetration with respect to technological, financial and social aspects.

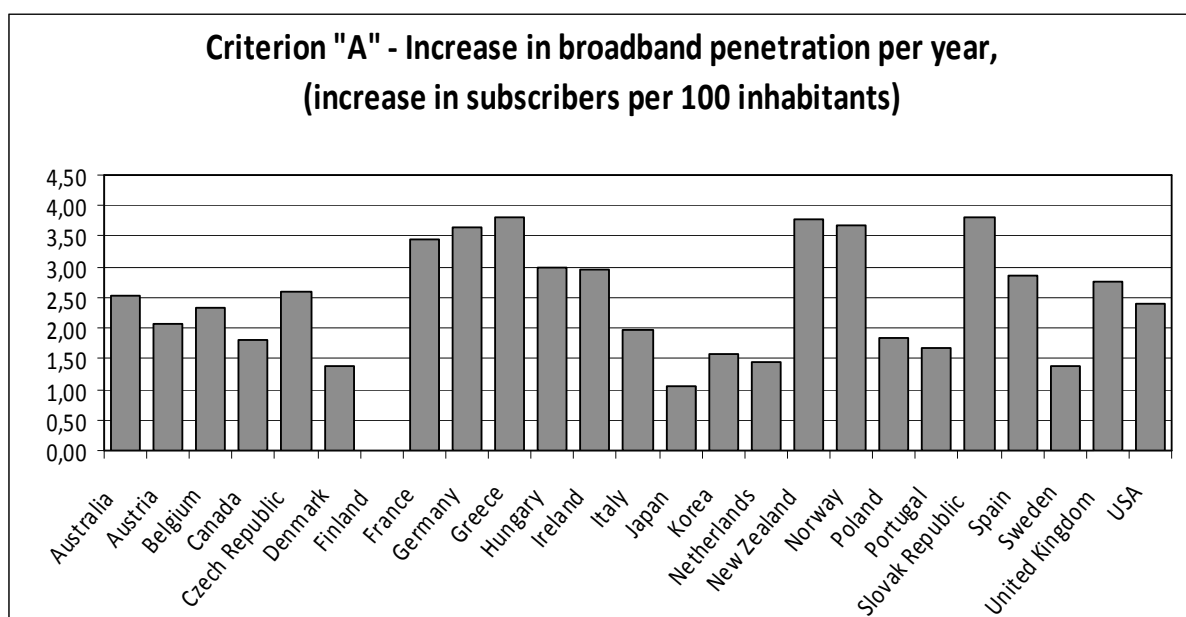
The group of selected countries represents countries from all 5 continents. For more detailed comparison of achieved results, proportional representation of Western European countries is higher.

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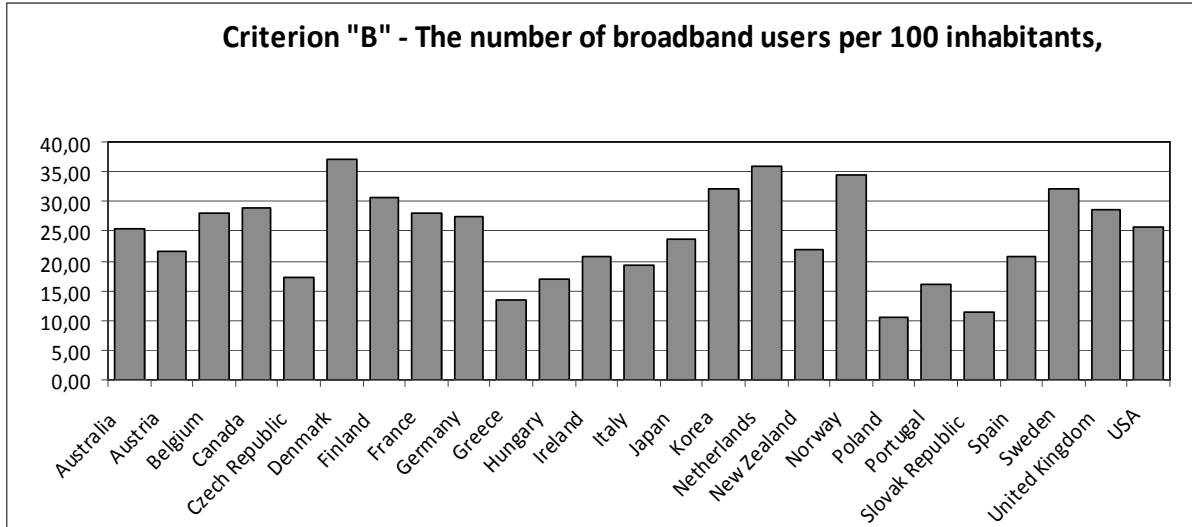
Evaluation criteria and weighted coefficients

According to abovementioned groups of successful growth of broadband accesses, I rate the selected group of countries based on 8 criteria. Criteria under consideration are divided into the following groups: technological (A, B, C and D), financial (E, F and G) and social (H). Criteria are not in order of priority. These criteria include:

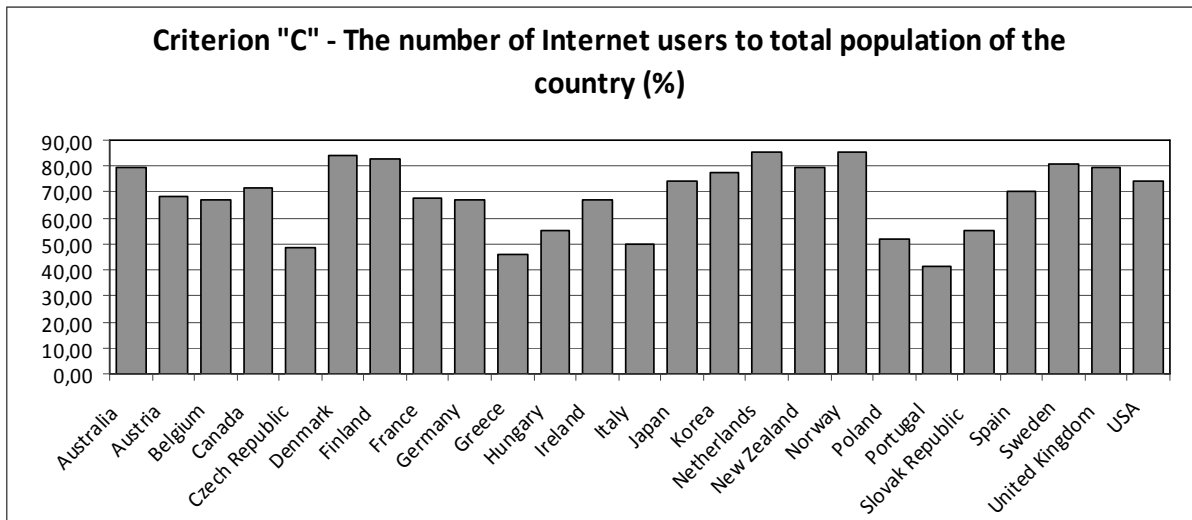
Increase in broadband penetration per year [4]. This criterion is referred as "A", and it is the most important of all.



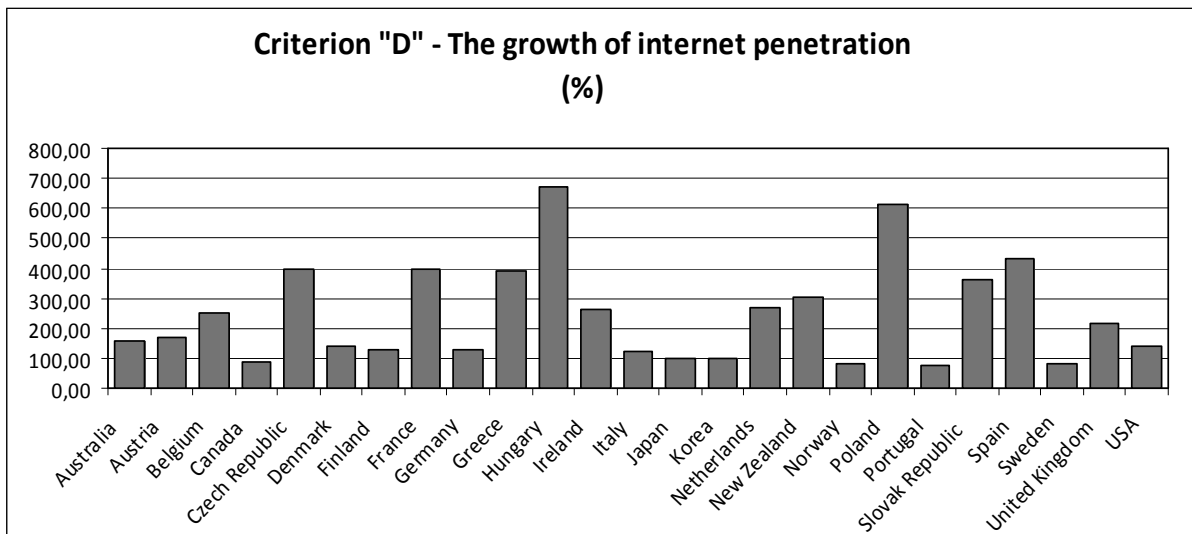
The number of broadband users per 100 inhabitants [5]. This criterion is referred as “B”.



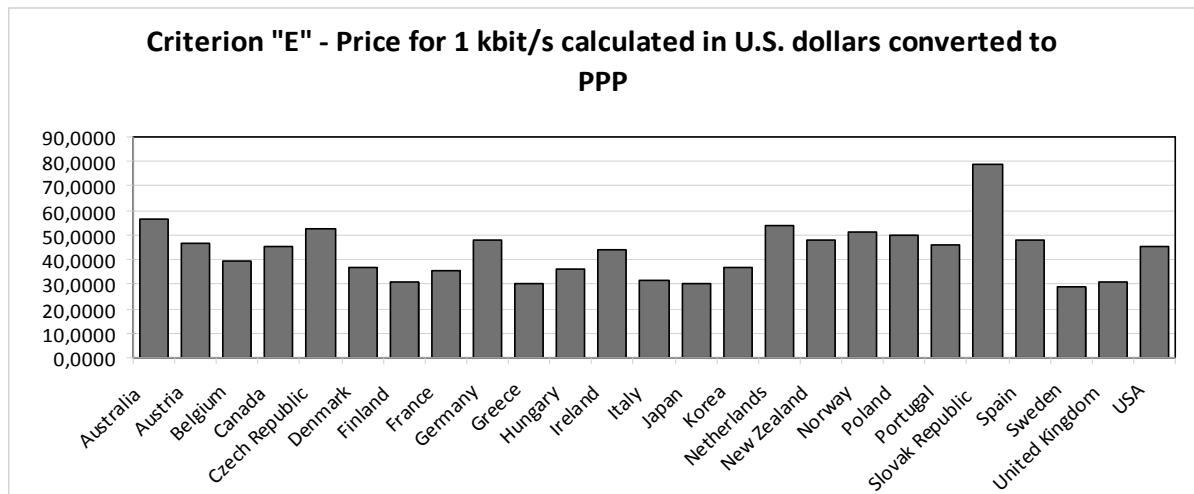
The number of Internet users to total population of the country. [6] This criterion is referred as “C”.



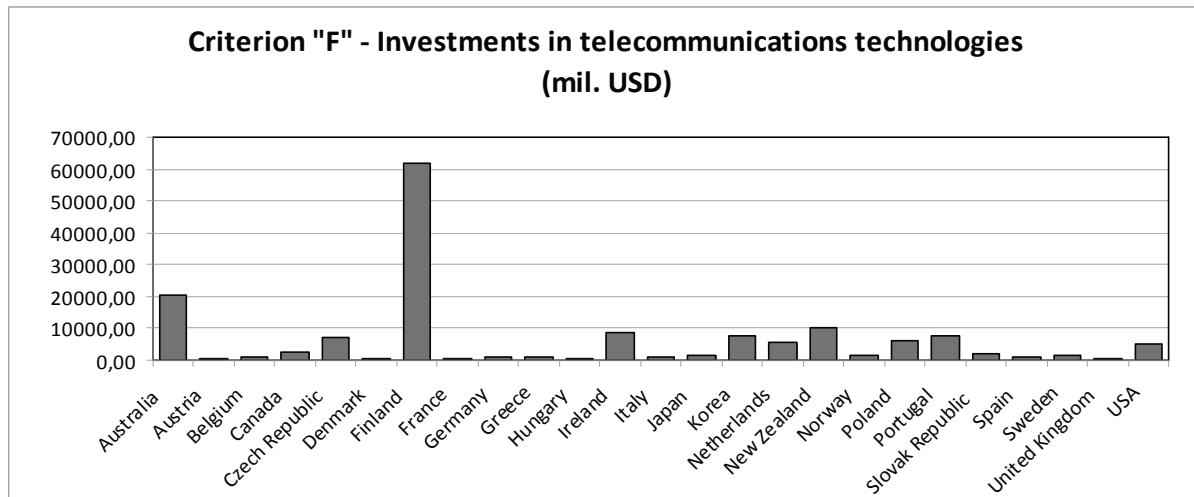
The growth of internet penetration [7]. This criterion is referred as “D”.



Price for 1 kbit/s calculated in U.S. dollars converted to purchasing power parity (PPP) [8]. This criterion is referred as "E".

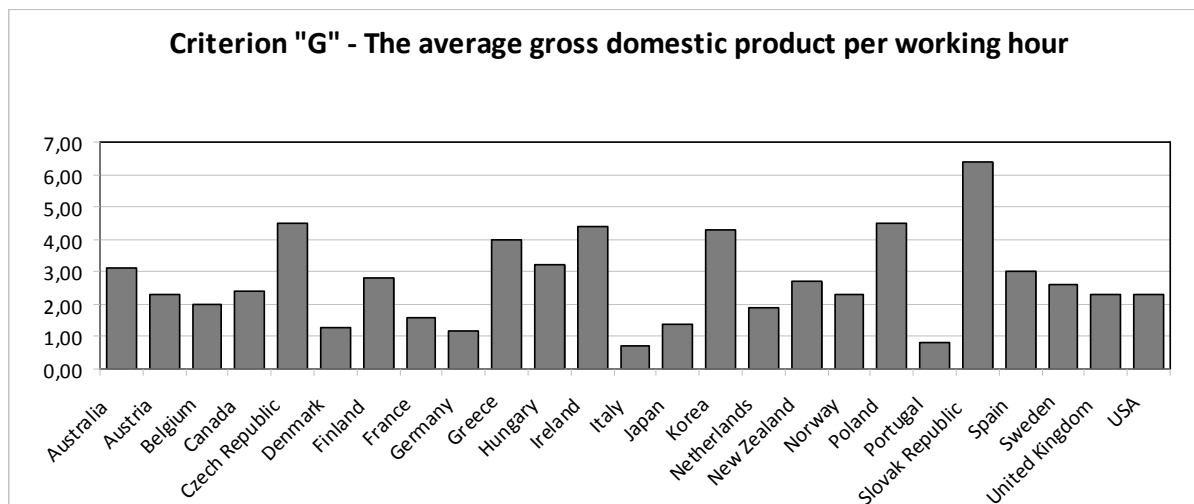


Investments in telecommunications technologies [9]. This criterion is referred as "F".

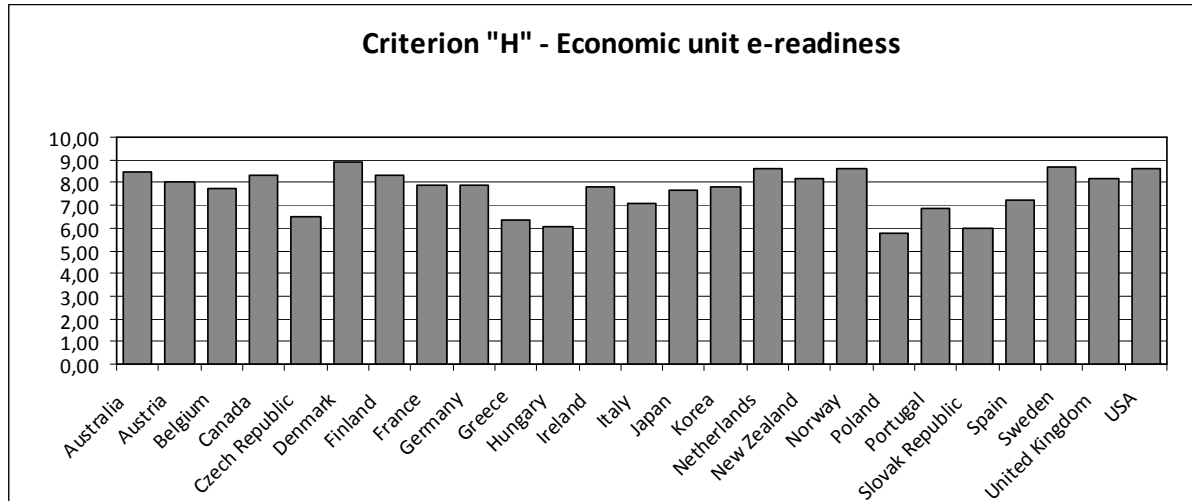


Points by the amount of investment is allocated in terms of funding levels (U.S. \$ million): less than 500 million - 3 points, 500 to 750 4 points, from 750 to 1000 5 points, from 1000 to 2500 6 points, from 2500 to 5000 7 points, from 5000 to 7500 8 points, from 7500 to 10,000 9 points and more than 10,000 - 10 points

The average gross domestic product per working hour [10]. This criterion is referred as "G".



Economic unit e-readiness [11]. This criterion is referred as "H".



To each criterion was set its weight according to its importance. Criterion weight = Weighting its importance during the process is determined by a factor of 1, 1.5 or 2. The most important technological criterion is the number of broadband users per 100 inhabitants and it has a weighting factor 2. However, 'the value of gross domestic product per working hour' criterion, which depends on several factors has, the weighting coefficient 1. Other criteria with the same importance for the growth in broadband accesses are rated with coefficient of 1.5.

Equation

Sum of all criteria multiplied by the rating factor gives us the overall country score.

$$S(i) = 2*(B) + 1.5*(C) + 1.5*(E) + 1.5*(F) + (G) + 1.5*(H). \quad (1)$$

The country with the score higher than an average and concurrently with high growth in broadband and Internet penetration is a country with good processes for the growth of broadband access. Calculation of best practice (INP) boundaries identifier is defined as the sum of average score for all countries and weighting coefficients.

The country with score higher or equal than INP is the country with the best practices for implementing broadband into life.

$$INP = AVERAGE\ VALUE\ (S1, \dots, Sn) + \text{sum of weight}. \quad (2)$$

Calculation of good practice (IDP) identifier is defined as the sum of average score for all countries and

hereby weighting coefficients A and D must be bigger than average value of them.

$$IDP \geq AVERAGE\ VALUE\ (S1, \dots, Sn) \text{ and hereby } A(i) > AVERAGE\ (A), D(i) > AVERAGE\ (D) \quad (3)$$

To convert statistical values for the number's range 1 to 10 we use this equation.

$$NUMBER_RANGE = STAT_VALUE \times \frac{x}{(\max.\ NUMBER_VALUE / \max\ STAT_VALUE)} \quad (4)$$

The number of criteria and their quantification was done with regard to the most objective evaluation of implemented procedures. Results are shown on fig. 2.

Analysis of results

Analysis of the results is dedicated to the description of activities and processes, which significantly support the growth of in broadband accesses. These activities include:

Improving user skills in ICT [12].

User skills are represented by individual capabilities for the effective administration of ICT systems and devices. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and tools supporting business functions within industry. Improving user skills is done by online IT introductory learning courses were made freely available for adults, including the unemployed, the low paid, the disabled, single parents and wife on maternity leave. Besides that, some countries have provided computer's literatures and training courses for primary or secondary schools.

Country	Criteria								Score	Result
	A	B	C	D	E	F	G	H		
United Kingdom	7,24	7,66	9,31	3,24	9,54	10	3,59	9,18	75,96	Best strategies
Korea	4,15	8,60	9,02	1,45	7,89	8	6,72	8,80	74,49	Best strategies
Sweden	3,62	8,60	9,39	1,20	10,00	6	4,06	9,77	74,02	Best strategies
Denmark	3,65	10,00	9,82	2,05	7,88	6	2,03	10,00	72,59	Best strategies
Netherlands	3,81	9,62	9,96	3,97	5,43	7	2,97	9,74	70,41	
Japan	2,78	6,34	8,63	1,49	9,59	10	2,19	8,67	70,22	
USA	6,27	6,94	8,65	2,07	6,42	10	3,59	9,70	69,61	
Norway	9,66	9,27	10,00	1,22	5,72	6	3,59	9,72	69,30	
France	9,03	7,53	7,90	5,90	8,21	9	2,50	8,90	68,56	Good strategies
Finland	0,00	8,25	9,67	1,88	9,55	3	4,38	9,36	68,25	
Canada	4,78	7,80	8,37	1,33	6,40	8	3,75	9,39	67,58	
Australia	6,67	6,83	9,29	2,34	5,20	8	4,84	9,53	66,52	
Belgium	6,14	7,55	7,85	3,74	7,37	6	3,13	8,69	63,11	
Germany	9,55	7,37	7,83	1,94	6,06	8	1,88	8,85	62,72	
Spain	7,51	5,59	8,24	6,45	6,06	8	4,69	8,16	61,56	
Ireland	7,74	5,54	7,85	3,90	6,65	5	6,88	8,84	60,47	
Italy	5,14	5,16	5,85	1,81	9,35	9	1,09	7,99	59,70	
New Zealand	9,90	5,89	9,30	4,55	6,12	4	4,22	9,26	59,00	
Austria	5,41	5,81	7,96	2,49	6,30	5	3,59	9,04	57,66	
Greece	9,97	3,63	5,36	5,88	9,72	6	6,25	7,14	55,83	
Hungary	7,85	4,52	6,48	10,00	8,07	4	5,00	6,81	52,06	
Czech Republic	6,82	4,62	5,71	5,96	5,55	4	7,03	7,28	50,08	
Poland	4,80	2,82	6,07	9,19	5,88	6	7,03	6,54	49,41	
Portugal	4,44	4,30	4,85	1,17	6,34	6	1,25	7,73	47,24	
Slovak Republic	10,00	3,09	6,45	5,45	3,71	3	10,00	6,79	46,10	

Fig. 2. Results of compared strategies

Increase internet penetration rates.

Increase internet penetration is associated with coverage of broadband access in rural areas, schools, hospitals and public centers. Low population density in rural areas causes high costs and low profits and prevents most providers away from doing business there. Development of Internet penetration in these areas is only possible by the joint financing of ICT infrastructure projects, respectively with government support.

Tax relief.

Tax relief is an important tool for increasing interest of using information and communication technology in generally, which can be applied in two ways. One is the tax scheme for employees. This can be represented by relief of a few percent from the provision of ICT services and from purchase of information and communication technologies, hardware devices and software applications. Also, on the other side, employers could prepare offer of ICT benefits for staff which they can use at home (computers, notebooks, video cameras, etc...). Then employers would apply the tax depreciation.

Development of broadband services.

Many countries aim at the development of broadband services for supporting e-services (e-government, e-health, e-business, e-commerce, e-etc...). In addition to these, a group of such services include distance learn-

ing, telemedicine programs and local community services operating in the region.

Changing regulating/regulation frameworks.

Almost all countries include regulation measures in their broadband strategies, which corresponding with principles of that the telecommunications sector shall be regulated, among other things, to promote and encourage the objective of fair competition in all fields.

Digital content development.

Preparation and creation of compelling digital content is an important part of developing a broadband strategy in all countries. At present we are witnessing a massive spread of digital content in P2P and social networks. Even from this perspective, the creation of quality multimedia content becomes crucial for the further development of broadband services.

Synergies promote between the private and public sector.

Mutual synergy between industry and the public sector is important not only in relation to the mutual development of both communities, but also in connection with the development of ICT services that are essential to the development economy of country. The key can be cooperation between research institutes and enterprises of the sector in order to develop the necessary infrastructure and resources.

Improvement of broadband access / services.

The idea of increasing the development of broadband access or services is mainly based on the means of extending access to information and communication technologies (ICTs) in unserved communities, especially in rural areas or closed.

Funding of research projects focused on ICT.

Funding research and innovative projects in the area of broadband is an important part of promoting the development of broadband services. Thanks to such activities can also improve quality of services or bring broadband services to rural areas.

Conclusions

This paper is aimed at the description of a methodology for evaluate procedures selected group of countries for broadband growth. Applying the methodology we have shown that countries which include United Kingdom, Korea, Sweden and Denmark thanks to the strategy are rated as the country with the best potential for growth in broadband penetration. Their broadband strategies can be used for inspiration to others.

Activities and processes, which significantly support the growth of broadband accesses and penetration are focused on improving user skills in ICT, increase internet penetration rates, tax relief, coverage of broadband access in remote areas, development of broadband services, changing regulating/regulation frameworks, digital content development, synergies promote between the private and public sector, improvement of broadband access / services and funding of research projects focused on ICT.

References

1. OECD, *Communications Outlook 2009*, electronic file available at http://www.oecd.org/document/44/0,3343,en_2649_34225_43435308_1_1_1_1,00.html.
2. Brunzel J. *Network Choices and Construction Practices within Multi-Dwelling Units*, FTTH Council Conference, Copenhagen 2009.
3. OECD, *Percentage of fiber connections in total broadband among countries reporting fiber subscribers*, June 2009, electronic file available at http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html.
4. OECD, *Increase in broadband penetration per year*, electronic file available at http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html.
5. OECD, *The number of broadband users per 100 inhabitants*, electronic file available at http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html.
6. *Internet World Stats*, *The number of Internet customers per 100 inhabitants*, electronic file available at <http://www.internetworldstats.com>
7. *Internet World Stats*, *The growth of internet penetration*, electronic file available at <http://www.internetworldstats.com>.
8. OECD, *Price for 1 kbit/s calculated in U.S. dollars converted to purchasing power parity (PPP)*, electronic file available at http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html.
9. OECD, *Investments in telecommunications technologies*, *Communications Outlook 2009*. – P. 114.
10. OECD, *The average gross domestic product per working hour*, electronic file available at <http://stats.oecd.org/Index.aspx?DatasetCode=PDYGTH>.
11. *Economist Intelligence Unit*, *E-readiness rankings 2009*, *The usage imperative*, electronic file available at http://www-935.ibm.com/services/us/gbs/bus/pdf/e-readiness_rankings_june_2009_final_web.pdf.
12. EC ICT, *European e-Skills 2006 Conference* Electronic file available at http://ec.europa.eu/enterprise/sectors/ict/e-skills/support/index_en.htm.

Поступила в редакцію 2.06.2010

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**ПРОЕКТ МЕТОДОЛОГИИ СРАВНЕНИЯ СОСТОЯНИЯ ИТ-ИНФРАСТРУКТУРЫ
В РАЗВИТЫХ СТРАНАХ НА ОСНОВЕ АНАЛИЗА
ТЕКУЩИХ ТЕНДЕНЦИЙ**

В. Мартышчак

Стремительное развитие информационных и коммуникационных технологий, поддерживаемое исследованиями в области оптики, привело к появлению достаточной полосы пропускания для новых широкополосных сервисов и приложений. Широкополосный доступ и сервисы на сегодняшний день видятся одинаково важными для развития бизнеса и общих перспектив страны. Благодаря этому, Интернет является не только сервисом, но и платформой, которая имеет значительный уровень влияния на все сферы общества. Интерес потребителей сфокусирован на конкретных мультимедийных сервисах с привлекательным контентом, который, однако, предъявляет различные требования к полосе пропускания. Эти сервисы включают IPTV, вместе с инновационными телевизионными сервисами, сервисами видеоконференций, виртуальные развлечения он-лайн, сервисами здравоохранения и новые трехмерные веб-сервисы. Внедрение результатов исследований и разработок в области широкополосного доступа в странах Организации по экономическому сотрудничеству и развитию (ОЭСР) разнятся несмотря на иные ожидания. Анализ шагов по внедрению широкополосного доступа в странах с очень высоким уровнем его проникновения дает возможность другим странам использовать соответствующие ноу-хау для их собственного роста с учетом их специфических рыночных условий.

Ключевые слова: информационные и коммуникационные технологии, широкополосные сервисы, Интернет

**ПРОЕКТ МЕТОДОЛОГІЇ ПОРІВНЯННЯ СТАНУ ІТ-ІНФРАСТРУКТУРИ
У РОЗВИНУТИХ КРАЇНАХ ШЛЯХОМ АНАЛІЗУ
ПОТОЧНИХ ТЕНДЕНЦІЙ**

В. Мартишчак

Стрімкий розвиток інформаційних і комунікаційних технологій, підтримуваний дослідженнями в галузі оптики, призвело до появи достатньої смуги пропускання для нових ширококутних сервісів і додатків. Ширококутний доступ і сервіси на сьогоднішній день бачаться однаково важливими для розвитку бізнесу й загальних перспектив країни. Завдяки цьому, Інтернет є не тільки сервісом, але й платформою, яка має значний рівень впливу на всі сфери суспільства. Інтерес споживачів, сфокусований на конкретних мультимедійних сервісах із привабливими контентом, який, однак, висуває різні вимоги до смуги пропускання. Ці сервіси включають IPTV, разом з інноваційними телевізійними сервісами, сервісами відеоконференцій, віртуальні он-лайн розваги, сервіси охорони здоров'я й нові тривимірні веб-сервіси. Впровадження результатів досліджень і розробок у галузі ширококутного доступу в країнах Організації з економічного співробітництва та розвитку (ОЕСР) відрізняються незважаючи на очікування. Аналіз кроків з впровадження ширококутного доступу в країнах з дуже високим рівнем його проникнення дає можливість іншим країнам використовувати відповідні ноу-хау для їхнього власного зростання із урахуванням їх специфічних ринкових умов.

Ключові слова: інформаційні та комунікаційні технології, ширококутні сервіси, Інтернет

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