Journal of Business Economics and Management
www.jbem.vgtu.lt
2010, 11(3): 415–427

APPLICATION OF E-TECHNOLOGIES FOR REGIONAL DEVELOPMENT: THE CASE OF VILNIUS CITY

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Received 2 June 2009; accepted 26 April 2010

Abstract. The investigation carried out by the authors of this paper under "Intelligent Cities" (Framework 6 programme) and e-City (Phare PPF) projects helped to identify and describe major trends of e-cities development in industrialized countries as well as providing recommendations for e-Vilnius development. Research included the following four stages: comparative description of the e-cities development in developed countries and in Vilnius, comparison and contrast of e-cities development in developed countries and in Vilnius, development of some of the general recommendations as how to improve the efficiency levels for e-Vilnius, submission of particular recommendations for e-Vilnius. In order to throw more light on the Model, a more detailed description of some above stages follows in the paper.

Keywords: intelligent cities, e-Vilnius, modelling, Framework 6 programme.

Reference to this paper should be made as follows: Zavadskas, E. K.; Kaklauskas, A.; Banaitis, A. 2010. Application of e-technologies for regional development: the case of Vilnius city, *Journal of Business Economics and Management* 11(3): 415–427.

1. Introduction

A fundamental reference in e-cities field are the actions (Europe's Information Society... 2005a, b etc.) put into effect by the European Union from the year 2000. On that date the European Council of Lisbon decided that the EU should aim at turning by the year 2010 into the most dynamic knowledge-based economy in the world. The aim of eEurope 2005 (Europe's Information … 2005a) is to provide a favourable environment for private investment and for the creation of new jobs, to boost productivity, to modernise public services, and to give everyone the opportunity to participate in the global information society. European Information society in 2010 ("i2010") (Europe's Information … 2005b) is an initiative which will provide an integrated approach to information society and audio-visual policies in the EU, covering regulation, research, and deployment and promoting cultural diversity. i2010 objective will be to ensure that Europe's citizens, businesses and governments make the best use of ICTs in order to improve

ISSN 1611-1699 print/ISSN 2029-4433 online doi: 10.3846/jbem.2010.20

industrial competitiveness, support growth and the creation of jobs and to help address key societal challenges.

The world's best scientists are working in these components: intelligent cities (Komakech 2005), e-city Europe: status, propositions and opportunities (Paskaleva-Shapira 2007), geographic information e-training (Beconytė *et al.* 2008), geographic information management (Stankevičius *et al.* 2010), e-Government strategies (Kahraman *et al.* 2007; Jakaitis *et al.* 2009; Kažemikaitienė and Bilevičienė 2008; Limba 2007), e-Procurement (Vitkauskaitė and Gatautis 2008; Gatautis and Vitkauskaite 2008), e-management (Davidavičienė 2008), e-commerce (Kaklauskas *et al.* 2007), e-interoperability (Gøtze *et al.* 2009; Gatautis *et al.* 2009), local readiness for city e-governance in Europe (Paskaleva 2008), citizens' expectations: implications for urban planning and design (Curwell *et al.* 2005), advanced transport management (McQueen *et al.* 2005), virtual trips and transport infrastructure planning (Jauneikaitė and Carreno 2009), virtual spaces and collaborative innovation (Komninos *et al.* 2007), street lamp monitoring and control system (Chen and Lin 2009); intelligent systems for real estate (Urbanavičienė *et al.* 2009a, b), negotiation (Kaklauskas and Urbanavičienė 2005; Kaklauskas *et al.* 2007), pollution and health effect analysis (Zavadskas *et al.* 2007a, b), international trade (Zavadskas *et al.* 2005), regional policy (Damaskopoulos *et al.* 2008), management of water resources (Dzemydiene 2008).

Several examples are described below. The Institute for Prospective Technological Studies (IPTS) defines five important thematic trends in ICT research: macroeconomic and social conditions for ICT-based innovations; ICT, organizational changes and transformation of work processes; the social dimension of ICT; political instruments related to ICT development. One of the main impacts of ICT is the capacity "to move people to the centre".

In this context the European Union declares a possibility "to move every citizen, home and school to the digital century; create literate Europe in digital systems supported by business culture ready to finance and develop new ideas; ensure that the process is socially comprehensive, creating consumer reliance and enforcing social cohesion".

This includes efforts like the development of e-learning, e-government, e-health, etc. E.g. digital technologies (remote network systems, Internet and mobile technologies) are used to facilitate the process of decision-making for public institutions, improve public policy in local communities and transform relations with citizens, business and other public institutions (Gatautis 2008).

The key drivers for enabling eBusiness development are commitment and support of industry associations, in particular in sectoral initiatives, synergies by having access to resources from other initiatives or organizations, competitive pressure and ease of participation. The key barriers slowing ICT adoption are competition among companies in the target group, Lack of awareness, often combined with mistrust regarding ICT and ICT service providers, costs, lack of internal ICT and management knowledge, Network infrastructure issues: access and interoperability, Legal uncertainties.

The European Commission has identified 3 factors that make it difficult for SMEs, in particular, to engage more fully with ICT and develop sustainable business practices: 1) the relatively high costs associated with investments in ICT; 2) the lack of technical and managerial skills and; 3) reluctance on the part of SMEs to network with other enterprises. The proposed framework summarizes the main policy directions derived from the analysis and the key areas of eBusiness support – Business environment, Skills upgrading, Network infrastructure, Trust infrastructure, Digital products and information services, Intangible investments and assets, Information, Government online (Gatautis and Vitkauskaitė 2009).

Vilnius is the capital of Lithuania and one of the country's oldest cities. The honour of founding Vilnius is justly given to Gediminas (a Lithuanian Duke) in the year 1323. The capital is listed in the World Heritage Register of UNESCO. The population of Vilnius is 700,000.

Vilnius city mayor stated the goals in the area of information society (Vilnius city municipality 2005): knowledge society development (to improve education quality according to knowledge society requirements; to improve education infrastructure and develop and support all-life education and qualification improvement system), economic development area (economic environment that supports business and investments; development of supportive environment for knowledge economy and formation of knowledge society clusters), innovation development area (environment for innovations and cooperation of science, education and business organisations; improvement of communication and information infrastructure), city council effectiveness area (improvement of current and development of new electronic public services to citizens and businesses; improvement of Vilnius city council management and operations efficiency).

2. Model for e-cities development

The research's aim was to produce an analytical model for the development of e-Vilnius by undertaking a complex analysis of micro, meso and macro environment factors affecting it and to present recommendations on increasing its competitive ability (Kaklauskas 2006).

The research was performed by studying the expertise on advanced industrial economies and by adapting it to Vilnius by taking into consideration its specific history, development level, needs and traditions.

A simulation was undertaken to provide insight into creating an effective environment for the e-Vilnius development by choosing rational micro, meso and macro factors. The word 'model' implies 'a system of game rules', which the sustainable e-Vilnius development could use to its best advantage. This research included the following four stages.

Stage I. Comparative description of the e-cities development in developed countries and in Vilnius: a system of criteria characterizing the efficiency of e-cities development was determined; based on a system of criteria, a description of the present state of e-cities of developed and transitional countries and Vilnius is given in conceptual and quantitative forms.

Stage II. A comparison and contrast of e-cities development in developed countries and in Vilnius includes: identifying the global development trends (general regularities) of the e-cities; identifying e-cities differences between developed countries and Vilnius; determining pluses and minuses of these differences for Vilnius; determining the best practice of e-cities for Vilnius as based on the actual conditions.

Stage III. A development of some of the general recommendations as how to improve the efficiency levels for e-Vilnius.

Stage IV. Submission of particular recommendations for e-Vilnius was presented at this stage. Each of the general recommendations proposed in the third stage carries several particular alternatives.

In order to throw more light on the Model, a more detailed description of some above mentioned stages of analysis follows: description of a system of criteria characterizing the efficiency of e-cities development, identifying e-Vilnius developmental advantages and disadvantages, determining the best practice and some lessons to be learned from advanced e-cities.

3. A System of criteria characterizing the efficiency of e-cities development

Micro, meso and macro environments have a direct impact on e-cities development opportunities. This may facilitate e-cities development or, on the contrary, may create constraints. When drawing up the system of criteria (indicators, indexes) that fully describes the e-cities development, it is worthwhile taking into account the suggestions of other researchers.

The e-City Index (e-City Network 2005) is a set of tools and processes for measuring the e-readiness of a city region, and assisting in the strategic planning of how and where Information & Communication Technologies (ICT) could be deployed. In measuring the e-readiness of a city region, cities will use the index assessment tools to derive indicators for the various theme dimensions. This process requires data and evidence to be accessed which will allow the city to determine its indicator levels. When completed, this results in an e-City Index for the city comprising the range of indicators in each theme (e-City Network 2005):

- Democracy (use of ICT and digital media tools by citizens to shape city vision, ICT based collaboration to influence policy making, one-to-one electronic interaction with city government over policy and decision-making, electronic submission of opinion to city government, business of the city government available online).
- Services (use of intelligent technologies to improve service delivery, electronic interoperability between city government services, conduct and conclude transactions electronically with city government services, downloadable forms/documentation on city government services, information on city government services available online).
- Procurement (automated and intelligent procurement systems, integrated electronic purchasing across multiple city government services, and multiple suppliers, pur-

chasing transactions managed electronically, electronic access to suppliers' data, electronic publication of city government purchasing requirements).

- Promotion (use of digital media to virtually experience city characteristics, ICT environments to allow sharing of city information and experience, customisable electronic interaction with city information and data, electronic promotion of city is segmented by target market, city is represented on the WorldWideWeb).

e-City Working Group (Dublin as a... 2001) produced quantitative, qualitative and rating assessment for each of the e-Cities (Copenhagen, Dubai, Dublin, London, Singapore, Tel Aviv and Washington) studied, on a range of criteria (central and local government leadership, infrastructure, labour supply, business building skills and entrepreneurial culture, legal and regulatory environment, availability of development and VC capital, financial incentives encouraging corporate investment, integration of technology and the digital divide).

The purpose of the Framework 5 project INTELCITY (INTELCITY 2002) was the development of a research "roadmap". This implies that identifying possible future visions and scenarios for the intelligent application of information communication technologies will enable cities to become more sustainable and able to map out research paths that offer the most potential in assisting society to implement them. Visions of the intelligent city see the potential for ICTs in helping to solve many of the current problems in cities, both in terms of the design and redevelopment processes and in terms of their operation and use.

The main outcome was 5 alternative visions and scenarios for the city of the future in the knowledge society: e-democracy city (social inclusiveness), virtual city (resource efficiency), cultural city (preservation of culture and diversity), environmental city (ecological protection) and post-catastrophe-city (resilience). On the basis of these possible future perspectives of urban development a large number of other alternative scenarios may be framed and forecasted.

These scenarios were analysed on the basis of the following criteria groups (INTELCITY 2002): equity, participation, accessibility, decentralized decision- making, safety, education, non-complexity, cultural heritage, population density, age distribution, migration, employment, globalization, distribution equity, allocative efficiency, optimization of use of resources, environment aesthetics, health situation, compact city design, multifunctionality, integration of technologies, degree of innovation, security of data, decision support systems, real time simulation, nD modelling and simulation, ICT domination, accessibility of technologies and information, information richness, technology awareness and societal integration of technologies.

In Framework Project 6 "Intelligent Cities" (Intelligent Cities project 2005) these and other scenarios were further analysed. For example, the modern city aims at being a "knowledge capital" and depends on education. The educated city should be accessible to all its citizens. The criteria describing strengths of the educated city are: Infrastructure (pre-school provision, quality schools for all, diversity of educational opportunity (e.g. faith schools, specialist colleges), availability of higher education facilities, high pen-

etration of new technologies enabling learning opportunities), People (culture of learning, lifelong learning opportunities, the "creative class", a skilled workforce), Business (links between education and businesses, good job opportunities), Culture (good public libraries and archives, high number of cultural assets, close proximity of educational facilities to each other and to cultural assets).

Following the above-mentioned and other criteria systems, the generalized criteria system for a thorough description of sustainable development of e-Vilnius was framed.

4. Identifying e-cities developmental advantages and disadvantages

Vilnius varies from the compared cities according to ICT infrastructure, institutional arrangements and government policy in ICT field, economic structure and functions, social, planning and legislative systems, institutions, traditions and cultures, economic performance, immigrant communities and other indicators.

After the analysis of Vilnius and compared cities it was established that Vilnius falls behind them according to a number of quantitative and qualitative indicators. Some of the indicators are provided below: ICT facilities are not that well developed; low level of ICT penetration in such sectors as education, health services, lower-tier municipal institutions; a fairly large informal economy; older generation is a much less active user of IS services and participant in IS in general; increased "brain drain" of ICT specialists; further deepening of IST as a separated, but not integrated into general socio-economic discourse field of activity and learning; lack of knowledge of teachers to use ICT in education; IST is treated as a separate subject only and not integrated into the learning process in general (especially in secondary education); widespread belief in ability to solve all problems by administrative measures, disregard to market laws; insufficient pace of growth of ICT penetration in to public sector and households; inefficient use of EU funds for IST projects; narrow scope of eGovernment services, a lack of detailed and sound public policy on the matter; an unstable and fragmented institutional framework for IS policy; a low rank of IS policy in comparison with traditional policies on the governmental agenda.

However, Vilnius has several advantages: dynamic development of IST and public interest in IST; new laws to leave behind administrative and intrusive regulation systems and to implement rules that support innovations, a variety of services and investments in telecommunications, data distribution, Internet services, eSignature services; liberalised telecommunication market; strong competition in mobile telecommunication market and in ICT services diminishes costs for end-users and offers new services; comparatively cheap education of ICT specialists; diminishing costs for Internet and hardware speed up the Internet penetration into households, business and public sector; growing ICT market size and value reflects the orientation of industry towards more knowledge-based activities; expanding ICT-related sectors (telecommunications, IT industry and services) and increasing level of ICT usage in service sectors; recognized need for expanding eGovernment services; private initiatives to support ICT infrastructure; participation in international ICT programmes; more efficient methods of e-learning; relatively low profit tax.

5. Determining the best practice and some lessons to be learned from advanced e-cities

While implementing projects "Intelligent Cities" (INTELCITY 2002, Intelligent Cities project 2005), e-City (e-City 2003) and other projects the experience of different cities was analysed by the authors of this paper and it helped to determine the best practice of e-cities development for Vilnius. In order to throw more light on the best practices, a more detailed description of some examples (virtual communities, greater community involvement in decision-making of societal decisions, etc.) is as follows.

Virtual communities portals-have proliferated and these are broadly of 2 types: creating a virtual space for 'communities of interest'; online access to information and services for residents of specific geographical areas. Whilst the former can exist devoid of any shared physical space and bring together users who are separated by large distances and are never likely to meet, the latter is built on the potential for 'real space and real-time' interaction of users.

Its aim is to support users as they live in their cities and communities, enabling decision-making, providing another access route to services, and a forum for discussion (Saragossa towards … 2003). New information technologies must not serve as another instrument of social or personal segregation.

On the contrary, its possibilites must be exploited in all its potential to put into practice new ways of relationship, virtual communities, spontaneous groups of shared interests, forums of debate and participation.

It is necessary to build a virtual city totally interrelated with the physical city and with a big density of contents and interactions. And it must be constructed from the acknowledgement that this will be only possible by spreading technological culture to the whole of society and creating spaces for the own society to build its own means of expression (Saragossa towards … 2003).

In many cities residents living in social housing are able to access a range of services electronically, including: information about their tenancy such as rent, reporting repairs or booking appointments online, online benefit calculators, paying rates or local taxes, rubbish removal, streetlight, pavement or road repairs. Even people without direct access to computers can use one-stop-shop call centers that are in turn using technology to deliver a range of local services (Saragossa towards … 2003).

The project E-VOICE (E-Voice … 2005) intends to concentrate on e-democracy/e-government in order to try and renew the political information, communication and interaction processes between elected politicians, the administration and the citizens – including young people – on a local and/or regional level at various locations in the North Sea Region with the support of the 'new' media (Internet, e-mail, sms, i-mode, etc.) in combination with the 'old' media (television, radio, (mobile) telephone, newspapers, etc). Some possible examples are: the organisational development of digital office hours – citizens get the opportunity to pose questions to mayor, aldermen and/or council members by e-mail or by direct communication via the Internet and web-

TV; online townhall (e.g. experimental broadcasts of the yearly local-council budgetary meeting); digital debates and online panel discussions for citizens; electronic neighbourhood groups (E-Voice … 2005).

As a result of the delegation of various functions to the local districts and the resulting increased focus on a flatter, less bureaucratic structure in relation to decision-making processes it became necessary to develop new methods for use in local government (INTELCITY 2002).

Xie (2003) describes a complex online decision support system, WebPolis, in the context of eGovernment and eDemocracy. WebPolis is designed to facilitate greater community involvement in decision-making and offers a series of public communication and community application modules useful to local governments through a common online interface for users (both citizens and officials). WebPolis communication modules include e-mail, community newsletters, discussion conferences, online resources metadata harvesting and searching engine, and online surveys. WebPolis application toolsets contain Decision Action Process, Geographic Information Systems databases, landuse suitability analyst, infrastructure cost analyst, economic development analyst, and GASB34.

In recent years, there have been growing demands for a more participative approach to societal decision- making and a higher level of accountability on the part of politicians and decision- makers. Concurrently, the development of the Internet has provided an infrastructure to achieve these ends through substantive e-democracy. e-Democracy systems have the potential to draw on developments in decision support systems (DSS), involving stakeholders and the public in societal decisions (Niculae and French 2005).

Ballas *et al.* (2003) demonstrates the potential for linking GIS-based spatial microsimulation decision support systems (SDSS) to Virtual Decision-Making Environments (VDMEs) to allow local policy makers as well as the general public to explore local policy problems and become more involved in the public participation processes.

It will therefore be of interest to local government policy makers and practitioners as well as to researchers interested in the prospects of policy simulation models for the enhancement of local democracy.

Also some other examples of the best practices were defined:

- Different advanced cities are using new technologies in order to render more efficient public services and to establish an integral Open Digital Administration oriented to the users participation and transparency.
- Estonia's cabinet meetings have only computers on their tables. All ministers and their assistants have access to a ministerial chat room for this purpose. This makes things work faster (Guardian Unlimited 2005).
- Modern service industries such as ICT are highly concentrated in the central areas of regional capitals (Competitive European Cities... 2004).
- The diversification of the local economy of Saragossa through the biggest presence of the advanced services and new technologies sector is essential to create skilled jobs and to increase productivity in an environment which is more and more com-

petitive and global. To get this, it is necessary to create the objective conditions to attract investments and companies of knowledge economy (Saragossa towards … 2003).

- The free/open source software is reaching in the last years the indisputable relevance in the world of computing (Saragossa towards … 2003).
- Jörgen S. Svensson (The Use of Legal ... 2005) investigates the use of expert systems as support to street-level bureaucrats in Dutch local social services. The background is a very high percentage of decisions made by the street-level bureaucrats that did not comply with existing laws.
- Also the other experiences of different cities have been analysed (Dublin as a... 2001):
- Copenhagen e-development revolves around a number of issues: close links have been fostered between the technology educational and research institutions and the commercial sector, Technology parks, university and enterprise; partnerships, incubation centres, training initiatives and incentives are all interacting with the other elements of the economy in stimulating innovation and adoption; perhaps, to be expected, Copenhagen has been particularly successful in overcoming the digital divide.
- Some factors contributing to Singapore's successful development as an e-City are: strong government leadership and vision coupled with the ability to drive change and deliver on the vision; a legislative framework that facilitates and supports e-commerce; financial incentives to encourage inward investment and ICT development and training; heavy government and corporate investment in technology and R&D.
- Some factors contributing to Washington DC's successful development as an e-city include: strong Government leadership and its commitment to putting all government services Online; a legislative framework to facilitate and support e-commerce; commitment to training the US workforce for high-tech jobs; availability of R&D tax credit for investment in ICT by business and tax breaks for ICT training; widespread public Internet access.

6. Conclusions

The following aspects were analysed in this paper and the conclusions are as follows: e-Cities should be well informed of the micro, meso and macro environment levels in which they operate; e-Cities analyse the micro, meso and macro environment levels and distribute their resources to take advantage of the opportunities and to minimize threats to their activities; micro, meso and macro level factors can be optimized; model for e-Vilnius development was proposed; some global development trends (general regularities) of the e-cities development were identified; some general and particular recommendations how to improve the efficiency levels for e-Vilnius were developed.

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ELEKTRONINIŲ TECHNOLOGIJŲ TAIKYMAS REGIONINĖJE PLĖTROJE: VILNIAUS MIESTO PAVYZDYS

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Santrauka

Šio straipsnio autorių atliktas tyrimas pagal projektus „Protingi miestai“ (6-oji bendroji programa) ir „E.miestas“ (Phare PPF) padėjo nustatyti bei aprašyti pagrindines kryptis, leidžiančias plėtoti e. miestus industrializuotose šalyse, ir pateikti elektroninės Vilniaus plėtros rekomendacijas. Tyrimą sudaro keturios pakopos: lyginamojo e. miestų plėtojimo išsivysčiusiose šalyse ir Vilniuje aprašymas, e. miestų plėtojimo išsivysčiusiose šalyse ir Vilniuje sugretinimas bei skirtumų tarp jų parodymas, bendrųjų rekomendacijų, kaip pakelti e. Vilniaus plėtros efektyvumą, sukūrimas ir sukurtų rekomendacijų pateikimas. Kad svarstomas modelis būtų aiškesnis, pateikiamas išsamesnis kai kurių pakopų aprašymas.

Reikšminiai žodžiai: protingi miestai, e. Vilnius, modeliavimas, 6-oji bendroji programa.

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