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Space and virtuality: new characteristics of inequalities in the information society and economy

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Abstract. *Recently it is becoming increasingly important to understand the role of information and communication technology factors in shaping social and economic differences. Theoretical as well as practical experiences of analyses confirmed that spatial processes of the diffusion of information and communication technologies (ICTs) largely influenced the economy and society of the 21st century. In the last couple of decades ICT became an integral part of our everyday life, with lots of effects on social and economic processes, but we may experience other motives of inequalities today as they were in the past, or we may at least find some new characteristics of inequalities in addition to the existing ones.*
Basically inequalities are appearing between social groups in dimensions of accessing information. In the background as reasons we could name qualification, age, gender, income and many other factors of differences, and last but not least geography as an important motive. Therefore the first aim of this paper is to emphasize among the complex factors of inequalities the increasing and altering role of space in information age disparities, when speaking about digital access possibilities of different regions and locations. On the other hand, since infrastructure development policies have recognized the necessity of ICT development, an increasing number of people have become able to access the new information channels, resulting that accessibility could now be treated as a background problem. In contrast with accessibility differences, recently a new type of disparity emerges: the differences between users in the quality of usage. This secondary disparity takes place in the virtual world. Therefore the second aim of this paper is to reveal what new elements of inequalities are present in virtual space in connection with usage differences, and how it changed traditional spatial disparities. By analyzing data of Hungarian examples, this paper attempts to make a distinction between first and second order spatial inequalities.

Keywords: ICT, information society, information economy, virtual space, regional inequalities, Hungary

JEL Codes: O18, O30, R12

1. Introduction

When speaking about modern age inequalities a growing group of factors can be forcefully emphasized among social and economic processes, which cannot be omitted in disparity researches. At the beginning of the 21st century alongside with traditional factors of competitiveness some new ones seem to emerge, which have radical effects on inequalities. Since social processes in the background of the nowadays very popular phrase of information society are discovered in fact recently, there are more and more practical experiences confirming that processes affecting regional differences are also showing new characteristics. By the

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appearance of the new innovations of information and communication technologies (ICTs) a transformation process has started, which has changed our opinion on social differences or economic advantages and disadvantages. Since recognising the growing importance of the notion of information society, modern social sciences have certainly the task to discover and evaluate the main characteristics of changes induced by the information age. Actually there is an increasing demand on clarifying what reasons are in the background of disparities. Among the influencing factors of the information inequalities both economic and social factors could be mentioned, and last but not least an increasing role is believed to be played by space (geography) as well. The explanation of the function of geography in information inequalities by the clarification of regional disparities and virtual space differences could serve the better understanding of recent days' altering processes, thus we may expect better policy solutions on developing ICT awareness and reducing digital inequalities.

Why space and virtuality should be stressfully emphasized? Why is it important to deal with spatial questions in a world, where information – that are the key factors of social and economic development – are available theoretically everywhere? To be precise, we only think that information is freely accessible for everyone and at all places of the globe. It was many times proved that the role of geographical space could be treated as a borderless and friction free world [1] [2] only if we look on the topic as a Utopian thing [3]. We could only theoretically state that ensured by new information and communication technologies the everyday troubles originated from spatiality could disappear, namely the ardently wished dream, the overcoming on space may become reality. Empiric results on the other hand still prove that geography matters today as well [4]. This concept realised that previous geographical principles are also standing their ground in recent new environment. It is important that possibilities of information communication network connections and infrastructural grounds of bandwidth, which determine the speed of communication connections, are still unequally distributed in space. This new form of communication is dependent on real world's spatial bounds, on geographical position of access points, materiality of cables, as well as on other infrastructural, social and economic influences outside the world of wires.

2. Theoretical considerations on principal factors of ICT inequalities

The research of ICT-based inequalities despite the novelty of this term is already not unknown in circles of national and international researchers. Basic works of Castells [5][6][7], Norris [8] or van Dijk [9] formulated many concepts on inequalities of the information society. Also regional aspects of this topic became widely analysed [10][11], however it has still a lot of questions to be answered, especially in relation with recent policy making and ICT management. Just to mention some, it is important to know how regions or localities differ from each other and what solutions are proper to manage and to develop the information society of the regions or specific locations.

When speaking about regional inequalities in an information society environment, new and somewhat complex definitions appear in scientific and policy documentation. Digital divide or sharply saying the digital gap is the expression of the researchers of information society on describing how specific the inequalities are in this environment. Digital divide is a multidimensional phenomenon with global divide, which reflects to the divergence of internet access between industrialised and developing societies, social divide, which concerns the gap between information rich and poor, and democratic divide, which signifies the difference between those who do, and who do not use the toolset of digital resources to engage, mobilize and participate in public life [8]. In the background of ICT-based differences there are (also) general social distinctions, namely income, education, gender or age differences of the population [12]. We should note that

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digital divide cumulatively foster existing social inequalities, therefore in many senses this phenomenon arises not just in information society. According to definitions of the OECD the main feature of digital divide is the difference of accessibility, which exists among individuals, households, economic and geographical regions, and which is determined by different variables of economy and society [13].

According to van Dijk [9] there are four major dimensions or phases of digital accessibility, which should be taken into account when trying to create a complex picture of information society development. Additionally we may assume that all can be in relation with different spatial consequences. Digital accessibility is firstly depending on the internal willingness of using ICT tools, placing motivational accessibility as the first factor of inequalities. Secondly material or physical accessibility is mentioned as widely known digital inequality reason. The third one is the accessibility originated from different digital skills (operational, informational and strategic), while the last one is in connection with the so-called usage accessibility, which refers to the diversity of applications and the habits of usage.

Theoretical researchers explain the altering role of the influencing effects of factors related to inequalities of information society mostly by the assistance of diffusion models (e.g. [14][15]), primarily starting from those inequalities are basically determined by the adaptation level of ICT. Social and spatial diffusion in time is characterised by an "S" curve, which shows a time-lagged shape depending on the development level of the analysed social group. As a result of later adaptation certain social groups (peripheral regions) are becoming relatively lagged behind, which can be realised in social and spatial inequalities. In phases of the adaptation process different types of inequalities can be discovered. In early adaptation phase, when only few applies ICT, differences can be seen in accessibility, in the phase of diffusion differences are between users and non-users, while in the phase of saturation differences in quality can be emphasised [14]. As a result, ICT-based inequalities can be more or less measured by the society's adaptation level; this however does not, or just indirectly takes into consideration components like information economy.

Inequalities of the application of information and communication technologies in function of the general development level of the economy and society can be described also in a complex way. Since the level of development has a significant multivariable character, numbers of social and economic factors should be taken into account. The resulted picture reflects both regional structure of information society development and a new dimension of socio-economic inequalities. The position in information economy and society has a sensible importance in regional competitiveness, therefore it can be interpreted also as a new factor of regional inequalities.

The inequality analyses of the predominantly social terms of development and the rather economic phrases of competitiveness are searching the answer whether new technologies are reproducing former regional structure of the economy, and fostering differences of competitiveness between regions, or rather shaping up new patterns of spatial structure. It was already clear at the beginning of the 1990s that differences in development are partially consequences of diverse reactions on the challenges of the information age, but not independently from the starting position of the local economy, infrastructure, or social structure and adaptivity. On the other hand at the beginning of the decade it was believed that Internet and the communication revolution may liberate economy from bounds of geography, since ICT can easily bridge physical distances and can defeat geographical barriers. In spite of disappearance of inequalities, however, the concentration of ICT and high-tech industries and the emergence of technological clusters showed the opposite processes. In these cases namely ICT contributes to the increase of competitiveness of cities, metropolitan areas and advanced regions, which stabilised former inequalities.

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In differences of economic competitiveness beside inherited inequalities new mechanisms appeared significantly as well. ICTs in global economic processes revaluated the factors of labour market by various solutions of distant working, or by placing administrative jobs (back offices) to other countries, or simply by the solutions of lease-work based upon the usage of information technologies. In the new information economy these regions and employees are sometimes called "peripheral workers" in contrast with the central regions' developed "core labour force". Lease-workers of peripheral regions are working only in routine distant jobs, and while they often use modern technologies, these people are not in the position to significantly alter their network jobs. Therefore certain regions become centres of development, while others are left out of this opportunity. Making distinctions between central and peripheral regions can be explained by many other economic and social reasons as well, therefore a better way of selecting prosperous or lagging behind areas is the multivariable approach.

Inequalities of the information age are often explained by general human factors, within those also geography-related ones are usually mentioned. The international World Internet Project survey, which was carried out annually in many countries, also reflected on the main diversity topics to be analysed [16]. Among the mentioned factors of inequalities the main ones are qualification, age, gender, ethnicity and income differences, but additionally urban-rural and regional differences were also recognized as decisive elements. According to this the role of space in differences is worth to be described in details not only theoretically but empirically as well.

3. Regional inequality characteristics: the first order disparities of information society and economy

Based on the above- mentioned theoretical considerations the role of spatial factors in inequalities can be divided into two groups. The first one covers factors which are primarily influencing the chance of accessing information. Basically those are measured by accessibility indicators and by the built up level of infrastructural circumstances. On the other hand a second group of factors could be defined, which in fact rely on the state of the first group of factors, but are exerting disparity processes on their own as well. The second group consists of indicators of usage habits both qualitatively and quantitatively. It could also be stated that while the first group of factors are basically connected to infrastructure diffusion in geographical space, the second one takes place basically in virtual space. Therefore it is right if we formulate two kinds of inequalities: the first order disparities of the information society and economy, those are regional inequalities, and the second order disparities of the information society and economy, those are inequalities in virtual space.

By the application of regional science's definition of external spaces, in the context of information economy and society only the space could be named external, which definitely had the momentum of localisation or the attachment to geographical (physical) space. The obvious localisation is made possible on the one hand by assigning data to traditional spatial units, settlements, municipalities or regions, on the other hand by spatial delineation of material objects with known geographical positions. All the formations that could be identified along these cross-sections are possible to be visualised in physical space, and herewith form the specific external space of information society.

Cable networks of information transference are representing the specific at the same time significantly important material fundamentals of the communication infrastructure that is forming the technical system of conditions of the information society. Actually the most important "public utility" of the information society,

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the cable system of information transmission plays the main role in the infrastructure-centred version of the external space of the information economy and society.

Concerning regional differences, the several times mentioned accessibility dimension of digital divide in many senses was shaped as a consequence of infrastructural inequalities based on geography. Regional level of built up infrastructure as well as distance from access points of networks is usually more unfavourable in geographically peripheral places. Accessibility is though a central category of the geography of information society. It worsens the chance of peripheries since the deployment of technical systems as the "soul" of network society is defined by regularities of economy (it is worth or not), hence infrastructure differentiates society and space also on its own. Centre-periphery relations live further in urban-rural differences, additionally inequalities are defined along city-hierarchy as a result of that nodes of information and communication networks are to be found basically in urban spaces, and the density of connecting services and activities is also the highest at these locations.

To prove that, empirical statistical experiments were carried out by collecting regionally detailed data on information society development. As a starting point we analysed the existing methodology to find the best measures of regional inequalities. Although there are many internationally well- known attempts to measure ICT-based regional inequalities or at least the level of information society development (see e.g. [17]), the formulated methods cannot be implemented one in one for all kind of regional analysis. The major problem is that international indices take into account variables, which are possible to be collected on country levels, but are rarely available for smaller regional units. The lack of territorially detailed data (basically due to the lack of small scale data collection) resulted that a large number of indicators should be left out from analysis, or alternative solutions should be found. That is why our calculation – represented in the followings – tried to find the best selection of variables in relation with information society development.

To represent first order disparities, namely the ICT-infrastructure based regional disparities within Hungary microregional (LAU-1) level data were collected for 174 spatial units. The first dataset was formulated by ICT-infrastructure related indicators, which represent the accessibility of information. Data were provided by the Hungarian Central Statistical Office and by surveys of GKIeNET (an ICT research company in Hungary). As a comparison of changes in time the dataset was created for an initial year (2003) and a final year (2010) depending on data availability. The final dataset for measuring first order disparities comprehends the following indicators:

- Number of personal computers in households per 1000 people (Source: GKIeNET)
- Number of mobile phone subscriptions per 1000 people (Source: GKIeNET)
- Number of telephone main lines and ISDN lines per 1000 people (Source: HCSO)
- Number of cable TV subscriptions per 1000 people (Source: HCSO)

By the application of microregional data firstly we tried to reveal general inequality measures in Hungary. The simple level of weighted relative standard deviation was determined for all indicators and for all years.

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Table. 1: Microregional scale inequalities of ICT-infrastructure indicators in Hungary

Indicators	Weighted relative standard deviation	
	without Budapest	with Budapest
PCs in households (2003)	26,2	27,9
PCs in households (2010)	5,0	8,0
Mobile phone subscriptions (2003)	4,6	7,0
Mobile phone subscriptions (2010)	3,2	5,4
Telephone and ISDN lines (2003)	16,4	14,1
Telephone and ISDN lines (2010)	18,4	17,5
Cable TV subscriptions (2003)	35,0	42,1
Cable TV subscriptions (2010)	24,1	28,2

Weighted relative standard deviation values represent comparable regional inequality indicators, where higher values refer to larger inequalities and lower values to much equal spatial character (Table 1.). Since many prior examinations proved that Budapest is largely different from other areas of the country, we made calculations also by excluding the capital city of Hungary. According to our results this was a good idea, since inequalities among microregions out of Budapest are much smaller than including this city (only the not so modern indicator of telephone and ISDN lines has not reflected the exceptional role of Budapest). It additionally confirms the hypothesis that urban and central areas (that is in this sense represented by Budapest) have a large differentiating role in most of the infrastructure disparities.

For testing the relevance of urban-rural and regional differences further analysis of variance could have been carried out. In the tests our key questions were whether there existed significant differences between urban and rural microregions, and between regions (measured on NUTS2 level), or differences were rather measurable within the group of urban, rural or definite regional units. The significance of urban-rural distinction and NUTS2 groupings of the 174 microregions were tested for all ICT-infrastructure indicators and for all years by the application of one-way ANOVA analysis.

The results show that there are significant differences between urban and rural groups of microregions in all factors of the analysis (Table 2.). This could be also interpreted as urban-rural disparity is a relevant factor in first order ICT differences. The additional Levene statistic for testing the homogeneity of variance is, however, only acceptable for the indicator of mobile phone subscriptions and for the telephone and cable TV variables in selected years, meaning that these are the indicators, where standard deviations within the testing groups are proved to be identical, which is desirable. In other cases this could only be assumed. When comparing the results by NUTS2 groupings the relevance of regional distinction was also confirmed except for PCs in households (2010). The results were showing significant regional grouping effects. Also the Levene tests show that the differences among the 7 NUTS2 units of the country are differing from the disparities within the regional units and the results are stable or significant except for the PC indicators.

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Table. 2: One-way ANOVA results for testing the relevance of urban-rural and NUTS2 groupings of ICT-infrastructure indicators in Hungary

Indicators	Urban-rural groupings			NUTS2 groupings		
	F	Sig.	Levene Statistic sig.	F	Sig.	Levene Statistic sig.
PCs in households (2003)	15,791	,000	,000	9,675	,000	,003
PCs in households (2010)	49,825	,000	,000	2,091	,057	,000
Mobile phone subscriptions (2003)	80,755	,000	,884	15,205	,000	,098
Mobile phone subscriptions (2010)	87,222	,000	,994	21,673	,000	,358
Telephone and ISDN lines (2003)	15,008	,000	,061	6,273	,000	,236
Telephone and ISDN lines (2010)	28,434	,000	,007	6,161	,000	,801
Cable TV subscriptions (2003)	23,519	,000	,004	7,026	,000	,078
Cable TV subscriptions (2010)	39,346	,000	,984	6,293	,000	,045

To sum up the outcomes of the calculations there are measurable regional inequalities in ICT accessibility in Hungary, which are also somewhat changing in time, but on the other hand also stable geographical motives could be noted. The tests confirmed that one of the most significant characteristic of disparities is the difference between urban and rural areas and the difference between Budapest and the rest of the country.

4. Socio-economic inequalities in the virtual space: the second order disparities

As by lots of social phenomena, in the case of information society we can often stumble upon social components, having system of connections or relations to each other showing spatial characteristics on their own. Theoretically these internal spaces of the society cannot be geographically localised at all. The new type internal spaces of information society offer huge volume of new experiences essentially originated from the simple formula that if it is really spoken about space, then geographical terms have their alternatives also in this environment. Virtual space or cyberspace is perhaps the best expression in professional circles on what could be named as specific inner space of the information society. One could have the opinion that cyberspace is only one of the appearing forms of inner spaces of the information society, namely also further inner spaces exist, however, all the other variants have some kind of a motive, which is in relation with basic terms and definitions of cyberspace, in other words only differences of denomination could appear. As a result of the information societal transformation, or to be more precise through the diffusion of new technical achievements – within that primarily the information networks – the new spatiality that emerged is sometimes also respected by the term of network space (e.g. [18]), or other times mentioned as information space [19]. The altered sense of space is also immanent of this expression, while unlike virtual or cyber formulas, this phrasing emphasizes or at least suggests another element of new spatiality: the changes arisen from information management.

Concerning its character cyberspace is quite divers and complex. This space could be characterised as some kind of a conceptual space of the flow of information and communication, which space came to

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existence through elemental combination of the digital world's hardware materiality, the software of computers, the telecommunication networks and human mind. Virtual space is not technology or infrastructure, but rather a medium, in which complex convergence of computers, communication and people seems to come true [20]. Cyberspace itself cannot be touched or seen, however certain tools make it possible (e.g. telephones or internet browsers). Cyberspace is real virtual, namely invisible creation to which at the same time real material consequences are connecting (e.g. commerce of real goods in e-commerce solutions of virtual space).

Concepts of defining cyberspace as a medium perceive only functional content of virtual space, and do not really take its social and economic influences into consideration. Namely fundamental character of cyberspace is that it has social origin as a whole. A social demand led to its birth, and the technical improvement of socio-economic development made its physical frames, in which man placed his consciousness with that becoming part also of the virtual space.

Spatial relations that emerged through interlacing of individual computers are reflecting spatial characteristics of the real world a specific way. In this sense cyberspace makes up space matching relativistic theories with ordered side-by-side position of spatial connections as spatial components. Absolutistic theories of spatial science on the contrary, or in line with this are on the opinion that cyberspace is the ether, which takes up and fills out spheres inside and in between computers [21]. Absolutistic space theory is also supported by the experience that users of virtual space may enter the sphere by logging in from the outside, consequently expounding this world as a separate entity.

Space of flows – as Castells [5] formulated – is fluid and offers wide moving possibilities for enterprises, which hereby may become independent of real physical space [22]. The network organisation, which typifies information and communication interactions of the economy and society, formed the characteristic structure of virtual space in the form devoid of traditional spatial constraints.

The diversity of interpretations or conceptual approaches of cyberspace obviously originates from the fact that representatives of theories talk about not always the same cyberspace. Eventually it is evident that a complex phenomenon like information society has a rather diverse appearance of inner space. Therefore, this inner space of information society is formed by spaces – in the plural – of the virtual world.

The changing character of ICT tools gives us the chance to explore new characteristics of inequalities in the information society and economy time by time. While – as previously mentioned – the technological innovations are always and continuously diffusing in time, the role of primer ICT background differences in regional inequalities is declining, resulting that from first order regional disparities we are stepping towards the increasing importance of second order virtual space disparities. Since infrastructure development policies have recognized the necessity of ICT development, an increasing number of people have become able to access the new information channels, resulting that accessibility could now be treated as a background problem. In contrast with accessibility differences, recently a new type of disparity emerges: the differences between users in the quality of usage.

This can also be proved by empirical experiments, therefore further statistical data were collected on the level of Hungarian microregions. This time the created dataset was focusing on indicators, which could better reflect usage habits of local people, companies and institutions. Data were provided by surveys of GKIeNET (an ICT research company in Hungary). The final dataset for measuring second order disparities comprehends the following indicators:

- Average level of e-administration (Source: calculations based on GKIeNET)
- Number of internet users per 1000 people (Source: GKIeNET)
- Share of companies with websites (Source: GKIeNET)

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- Number of internet subscriptions per 1000 people (Source: GKIeNET)

The next calculation tried to measure usage inequalities represented again by weighted relative standard deviation values (Table 3.). According to our research outcomes the datasets including Budapest in most cases reflected higher inequality levels than data without Budapest. The result confirmed again that central areas play an important role in disparities. Additionally among the weighted relative standard deviation results extraordinary large values could be observed by the indicators of the average level of e-administration. That is because there are still a lot of microregions, where there are no registered settlements with e-administration activities. On the other hand huge steps were made in order to develop e-administration solutions in cities and villages and to enhance inclusion in the information society, which was reflected in the large reduction of the weighted relative standard deviation index. It is easily observable that all indicators of information usage have gone through perceptible equalization that is the consequence of diffusion of cyberspace technologies among people.

Table. 3: Microregional scale inequalities of information usage indicators in Hungary

Indicators	Weighted relative standard deviation	
	without Budapest	with Budapest
Avg. level of e-administration (2003)	900,4	912,1
Avg. level of e-administration (2010)	288,1	290,1
Internet users (2003)	21,8	17,9
Internet users (2010)	10,1	13,4
Share of company websites (2003)	17,8	27,7
Share of company websites (2010)	9,4	11,1
Internet subscriptions (2003)	18,0	26,6
Internet subscriptions (2010)	9,4	12,3

If we look on the ANOVA table of information usage indicators, again the significance of the F-statistic results could be observed at all indicators and this time in all years. This confirms our assumption that urban and rural groups of microregions have significantly different values in information usage indicators, and this is also the case, when we are speaking about NUTS2 groupings of microregions. According to our Levene tests, the outcomes of the analysis are fully acceptable only if Levene Statistic significance values are over 0.050, which is the case of many of the variables, while others are only forming assumptions. All in all the vast majority of the observed phenomena have measurable between group inequalities rather that within group disparities.

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Table. 4: One-way ANOVA results for testing the relevance of urban-rural and NUTS2 groupings of information usage indicators in Hungary

Indicators	Urban-rural groupings			NUTS2 groupings		
	F	Sig.	Levene Statistic sig.	F	Sig.	Levene Statistic sig.
Avg. level of e-administration (2003)	15,572	,000	,002	11,418	,000	,000
Avg. level of e-administration (2010)	21,200	,000	,313	25,532	,000	,134
Internet users (2003)	86,238	,000	,091	8,159	,000	,204
Internet users (2010)	116,714	,000	,006	11,187	,000	,788
Share of company websites (2003)	28,663	,000	,035	7,227	,000	,111
Share of company websites (2010)	12,174	,001	,006	10,711	,000	,000
Internet subscriptions (2003)	23,397	,000	,674	20,154	,000	,137
Internet subscriptions (2010)	83,174	,000	,198	19,647	,000	,092

5. Conclusion

Although spatial disparities of the information age are first of all determined by externalities of ICT infrastructure, it seems that those have an inheritable effect on virtual space inequalities, namely on user activities as well. While there are obvious inequalities in the so-called external spaces, the importance of inner space (virtual space) disparities are also remarkable. Measurable structural elements of regional disparities are therefore the differences between centres and peripheries, as well as the differences between cities and villages, additionally in the digitally divided world of cyberspace new social gaps between "people inside" and "people outside" are remarkable, which were tested through proxy indicators of information usage.

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