

Information and communication technologies in Poland – regional perspective

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Abstract

The evolution of information and communication systems contributed to significant increase in speed of information flow. These processes occur in different areas, both in households and businesses, helping to build a knowledge-based economy. In addition, the demand for digital technology improvements steadily increases, which in the way gives foundations for the functioning of the information society.

The purpose of the article is to implement spatial and temporal analyses of the modern telecommunication infrastructure development in Poland in regional terms. Using the taxonomic method, it was possible to expand the scope of the study, taking into account the history of the development of the ICT sector, the current state and prospects of its further expansion. The major part of the study has been focused on a comprehensive comparative analysis between the Polish regions.

Keywords: *information society, information and communication technologies, spatio-temporal analysis*

JEL Classification: C1, O11, P25

1. Introduction

Access to modern telecommunication infrastructure (TI), especially broadband Internet access is a necessary condition for functioning of the information society. In addition, the information and communication technologies (ICT) sector is a key pillar of the knowledge-based economy of which development has become a priority challenge for many countries, including Poland. This attitude is created by pro-innovation policy of the European Union.

Modernisation and development of digital networks involves huge financial outlays. Funds may be derived from different sources: the private sector, the state budget, as well as the EU resources. EU subsidies are directed primarily to the local government units or the SME sector. These entities, however, do not have a sufficiently high potential for implementation such a significant investment. The central authorities, on the other hand, are not able individually to cover all the costs associated with telecommunications projects. As most essential player in this field, therefore, the sector of large enterprises, which are

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leaders in the telecommunications industry, could be considered. Though, activation of this sector requires economic incentives and favorable institutional environment.

The purpose of this paper is a multi-dimensional analysis of the level of development of the modern TI on Polish region. Research issues have been presented in regional terms, since already at this level, the expansion process of digital networks begins. It was assumed that there is a significant interregional development of the ICT sector disproportion in Poland. The taxonomic measure of development was implemented and the results were used for calculating the ICT indices and for classification of Polish provinces. Analysis was carried out for years 2003-2014.

The rise in popularity of the aspects of TI resulted in vast number of publications related with this issue. Some of the papers reflect the conceptual and theoretical framework, some of the research have empirical characteristics. Among the Authors who dealt with ICT issue, one could indicate: (Pradhan et al., 2015; Wonglimpiyarat, 2014; Bhat et al., 2003).

2. The elements of information and communication technologies

Rapid technological progress causes the emergence of new solutions in the ICT sector. Stationary telephony that was popular at the turn of the twentieth and twenty-first centuries is currently characterised by decreasing penetration. This process is obviously related to the transformation of the telecommunications market, i.e. replacing it by a mobile connections and Internet technologies. Similar tendencies can be observed among recipients of television and radio, the number of which is also decreasing (Fig. 1). This situation confirms the growing role of the Internet, and for this segment of modern TI the highest attention should be given, when it comes to the further development of this sector.

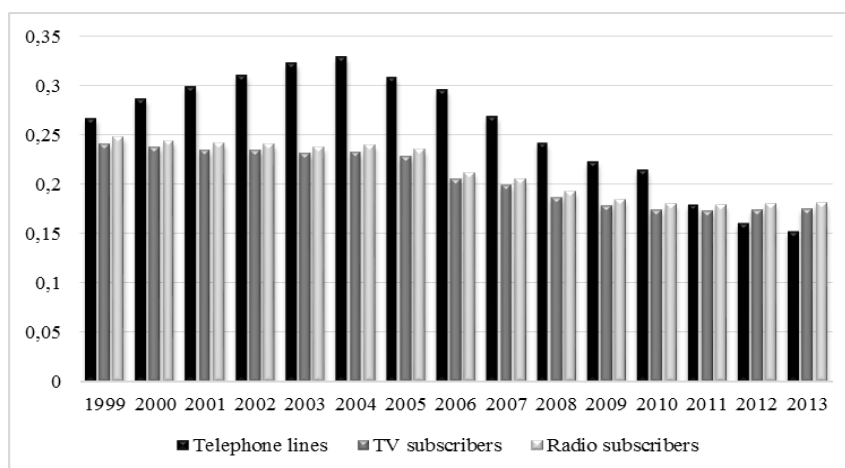


Fig. 1. Telephony, TV and radio subscribers in relation to the total number of the population.

An origin of the Internet dates back to the 1980's of the XX century. In Poland, the first Internet connection was established several years later. During this period, the Internet access was made possible only by the fixed link. Nowadays, more and more become popular wireless connections. Findings in the report (Zieliński, 2012) indicated that this results from the emergence of a new generation of terminals, i.e. notebooks, smartphones and tablets. It can be stated that broadband Internet has the greatest impact on the development of the electronic communications sector that includes such services as the voice transmission, e-mails, searching and transmitting of data, or media services (including TV and radio), etc. Development of the Internet has given the opportunity to use it for doing business. E-business was created, which generates changes in the structure and functioning of traditional enterprises, for instance: through e-commerce and mobile financial markets. In addition, some of the important features of the Internet can be pointed out, especially related to its business ground: mass scale, efficiency, immediacy, interactivity, speed and measurability (Grysa, 2008).

The current state of modern TI in Poland has been described in detail in the report of the President of UKE for 2013 and 2014. The major part of the paper was devoted to broadband Internet, also from a regional perspective (*Raport pokrycia terytorium Rzeczypospolitej Polskiej...*). As far as the levels of investment and the development of ICT in Poland are concerned, they are strongly related to the European Digital Agenda, which is one of the seven flagship initiatives of the Europe 2020 Strategy. In the Agenda, the attention was paid to the importance of dissemination of broadband Internet, on one hand, to promote social activity, on the other hand, to pick up the competitiveness of the European Union economic. Therefore, a goal was set that by the year 2020, every European citizen would have accessed the Internet with a connection speed higher than 30 Mb per second. It is also aimed that at least half of European households would have access to connections of speed above 100 Mb per second. Furthermore, infrastructure development is also accompanied by enriching the offer and increases in the quality of public services, as well as, with the development and availability of information resources administration. In the documents of Ministry of Administration and Digitisation Poland 2030 and the Long-term National Development Strategy, the access to the Internet for all of the citizens was indicated as the strategic objective. Hence, it is necessary to cover the whole country with TI with parameters enabling the provision of advanced broadband services.

3. Information society, as the primary recipient of ICT

The issue of the information society as the primary recipient of modern TI cannot be omitted. There are many definition of the information society, which most are not cross-consistent. In general, information society characterises population by its ability of using information systems and telecommunications services to transfer and to process information remotely (Sienkiewicz and Nowak, 2008). Defining this issue broadly, the attention should also be drawn on economical, occupational, spatial, legal or cultural factors (Webster, 2002). Functioning within information society is based on the information diffusion and its usage in achieving both professional and personal objectives. Therefore, knowledge workers start to play a dominant role and innovation, creativity and flexibility are fundamental stimuli of business efficiency (Lavie and Rosenkopf, 2006).

The development of the information society would not be possible without modern TI and the possibilities that it brings. Well-functioning public administration, which should be even more open to new technological opportunities, can contribute not only to the reconstruction of internal processes, but also to the provision of electronic public services (Aldrich et al., 2002). Consequently, it can be stated that components of the information society are its actors i.e. people, enterprises, public administration, ICT infrastructure and the information.

Using modern software and digital tools, performers generate and process data. In this way many e-services were enabled, i.e. e-business, e-government, or e-learning, e-health, etc. The foundation for creating and sharing such content is the modern telecommunication infrastructure. That is the reason the emphasis should be placed on its development, while not ignoring the need to improve the competence of the people, companies and public administration, as it is these entities that are the users of the system (Woźniak, 2008).

4. Assessment of ICT levels in Poland in regional terms

The analysis of the development assessment of modern TI in the Polish provinces has been based on 7 diagnostic features. The data were obtained from the Local Data Bank of the Central Statistical Office of Poland. Data bank was summarised in the distribution panel (with dimensions of 16 areas – Polish voivodship and of 12 time periods – for years 2003-2014). For overall comparability, the variables were transformed into indicators, and five of them were related directly to the ICT sector: *LT* – telephone lines per thousand inhabitants (units); *K* – percentage of households equipped with computers (in %); *AT* – cable television subscribers in relation to the total population (in %); *UI* – Internet users – percentage of

households with Internet access (in %) and *WNO* – software expenditures in industrial enterprises, as a share of Gross Domestic Product.

The other two indicators were related to the general functioning of the economy in the provinces, such as: *GDP* – Gross Domestic Product *per capita*, in current prices, Poland = 100 (in %) and *WZU* – rate of poverty risk – percentage of people whose equalised disposable income (including social transfers) is lower than the poverty line set at 60% of median equivalent disposable income in the country – this variable was treated in the analysis as the destimulant. The characteristics of general functioning indicated indirectly the connection between observed in each region the level of Gross Domestic product *per capita* with the rate of poverty, which allowed to determine whether voivodships are more for investments in society's living conditions or the ICT development.

On the basis of diagnostic features and using the taxonomic measure of development in reference approach, the value of the ICT indices were estimated for years 2003-2014, according to the formula:

$$ICT_i = (1 - \frac{d_{i0}}{d_0}) * 10, (i = 1, 2, \dots, n), \quad (1)$$

where d_{i0} is the Euclidean distance between object and assumed pattern of development and

$d_0 = \sqrt{\sum_{j=1}^m (z_{0j} - z_{-0j})^2}$ defines the Euclidean distance between assumed pattern and anti-pattern of development. The variables were firstly normalised according to the quotient conversion and those highly cross-correlated and of low volatility were eliminated for the data set. For all methodology on numerical taxonomy – structure, segmentation, diagnosis of obtained results see: Suchecki and Antczak (2010). The history, achievements and methodological use of taxonomy was described by Pocięcha (1988).

The indices ranged from 0 to 10 and could be interpreted that the greater degree of development of modern TI is the higher values of ICT indices characterised the region. In contrast, lower index values indicate regions with a low degree of advancement of the sector. For visualizing the tendencies of changes of the indicators, figures for Information and Communication Technologies indices in years 2003-2014, were generated and were presented below in a trellis shape table (Fig. 2). For general comparability a uniform scale was assumed for the charts (ranging from 0 to 8 units).

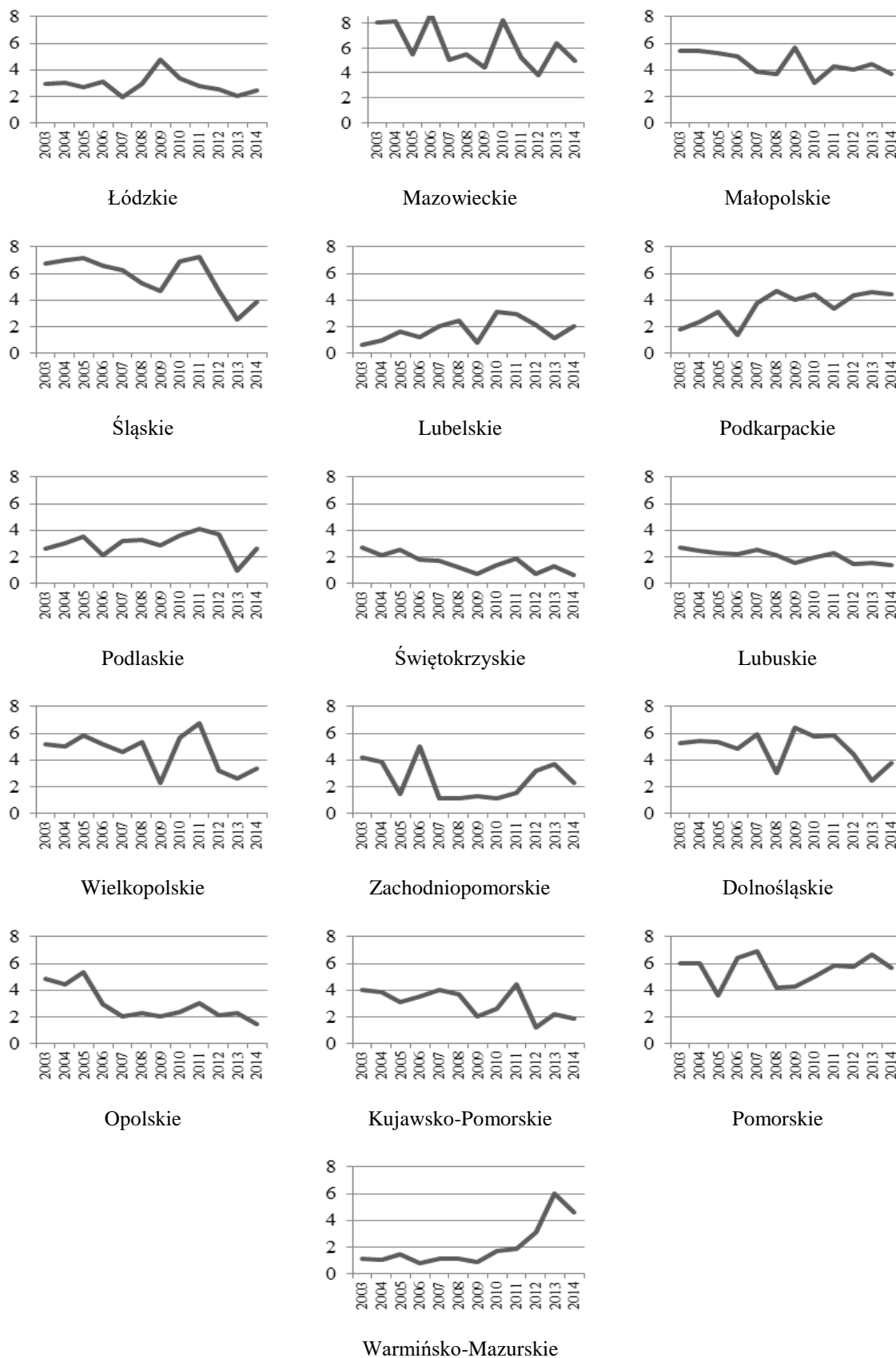


Fig. 2. ICT indices for Polish provinces – change in time.

This set of graphs indicated a significant regional disparity in the development level of modern TI in Poland. In addition, considerable fluctuations in ICT indicators has been noticed, which leads to conclusion that the system was not efficient and did not operate effectively. It is not possible to specify a leader in the ICT field, for which the curve runs across the highest points assigned for the indicators.

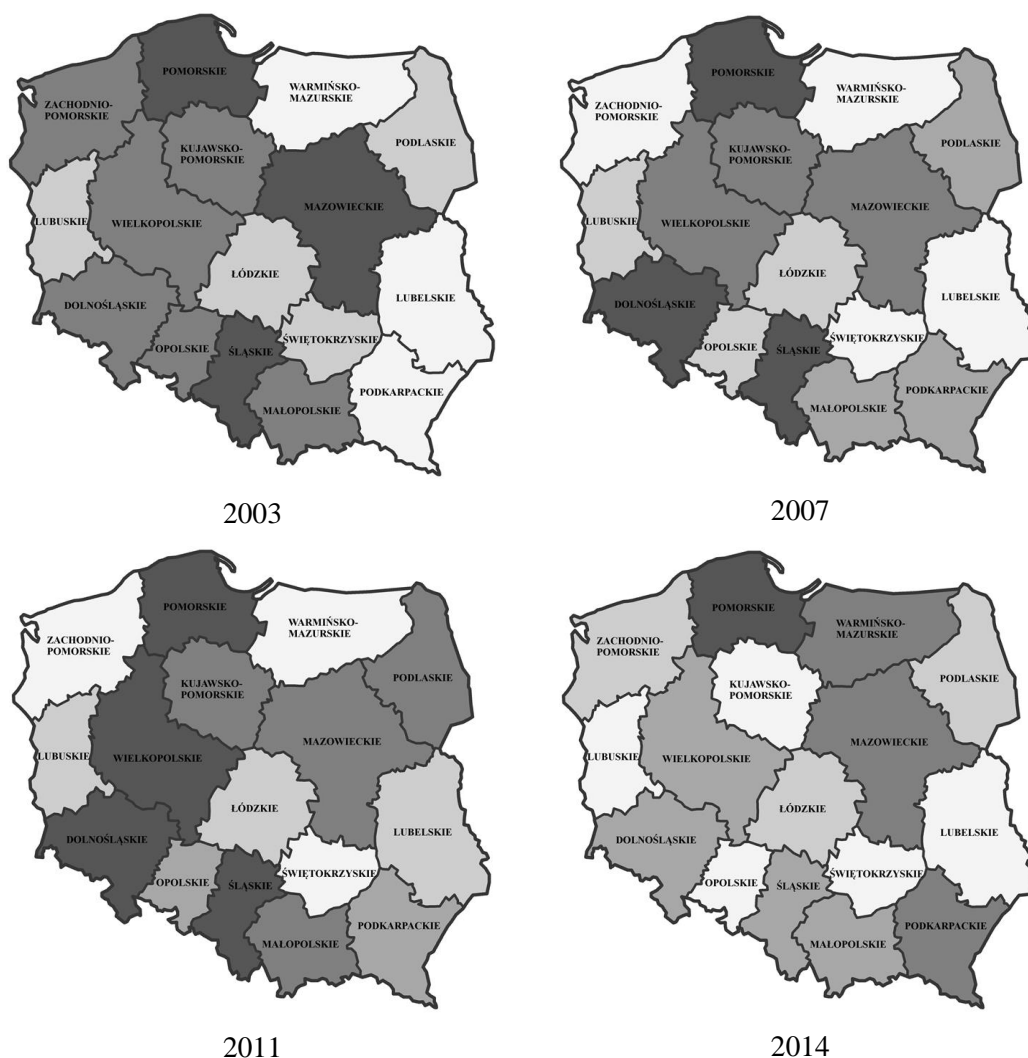
Although, relatively advanced regions in terms of the development of modern TI can be distinguished, provinces such as: Slaskie, Dolnoslaskie, Pomorskie, Wielkopolskie and Mazowieckie, which were characterised by significant fluctuations in the value of the index. In contrast, Lubelskie, Swietokrzyskie, Lubuskie and Warminsko-Mazurskie provinces were the weakest in the ICT development standings – however, Warminsko-Mazurskie recorded significant increases in the index value in the final periods of the analysis. For the purpose of indicating of spatial dependencies, the values of ICT indices have been visualised in each of the following periods: 2003, 2007, 2011 and 2014 (Fig. 3).

Spatial diversity of the ICT sector in Poland in the analysed years was at the high level. In 2003, the year preceding Polish accession to the structures European Union, three dominant ICT areas can be indicated, i.e. Mazowieckie, Slaskie and Pomorskie. In addition, one could observe a cluster of five provinces with relatively high coefficients of ICT in the western part of the country (with the exception of Lodz and Lubuskie voivodships). The sixth region (Malopolskie), which belongs to this group, was detached from the rest of the regions and did not bordered with any other from that cluster. Areas with low ICT indices were located in the eastern part of the country. The average index value for all provinces in 2003 amounted to 4.01 units. For 2007 the illustration of spatial distributions appears to be quite different than in the first period of the analysis. Still, three regions remained dominant, but this time the leaders cluster consisted of Slaskie, Pomorskie and Dolnoslaskie provinces. Mazowieckie voivodship was attributed to the lower group together with the Kujawsko-Pomorskie and Wielkopolskie. Brighter tones of shades indicated that the level of ICT in this period for most of the areas has slightly deteriorated. The largest decreases were recorded in Zachodniopomorskie, Opolskie and Malopolskie provinces. The average ICT index value in 2007 for all regions pointed on 3.48 units.

In the next period of analysis (year 2011), the previously dominant cluster was expanded and the Wielkopolskie voivodship has been annexed to this group. In this year the group of “highest” ICT indices values was most numerous, however Mazowieckie still was attributed to the second, middle cluster, and at the same time, Podlaskie voivodship has advanced to this group (previously recording lowest values of ICT index). The cluster of the “lowest” ICT

values has still consisted of province of eastern Poland and Zachodniopomorskie, Lubuskie. Average ICT for 2011 amounted to 3.95 units.

The most up-to-date data for 2014 indicated substantial declines in the ICT indices values. On average, this time ICT index dropped to 3.06 units. In addition, only one province (Pomorskie) managed to exceed the level of 5.5 units of the ICT index. Province, which had previously recorded higher levels, this time were in the lower level groups of ICT development. Some of the declines could be considered drastic (especially for previously indicated as leaders: the Slaskie, Dolnoslaskie and Wielkopolskie voivodships). Worth mentioning, is the significant improvement of the situation in the eastern provinces: Podkarpackie and Warminsko-Mazurskie.



Level of measurement:

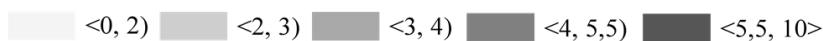


Fig. 3. Spatial differentiation of ICT indices in Poland in: 2003, 2007, 2011, 2014.

Conclusion

Access to modern telecommunications infrastructure, in particular to the broadband Internet, is essential for socio-economic development in the XXI century. Poland, unfortunately, is losing, in this sector, when compared with most European Union countries. Lack of access to digital technology is noticeable especially in rural and less urbanised areas. At the same time, it should be emphasised that the development of the information society is one of the objectives of the pan-European Union initiative. Moreover, the implementation of this aim is a breakthrough phase of civilization, thus enabling all citizens to have access to modern technology is a prerequisite to catch up with high developed countries. This vision for a country like Poland, which remains attractive for the society as well as the investors, entails the activity of central and local authorities, aimed at the pursuit of development and modernisation of telecommunications networks.

Development of ICT in Poland does not proceed in an efficient manner, which was indicated in the research results. The analysis confirmed the hypothesis of a significant diversity of development in this field in the Polish provinces. Significant fluctuations in indices of ICT and the lack of significant upward trends confirmed also the weakness of the system in general. The processes related to network expansions, still appears to be problematic from the financing perspective. An increasingly popular formula of public-private partnership, proved to be ineffective, mainly due to the discrepancies in determining of priority projects and the lack of compatibility between public and private entities. Formal and legal complications and lack of impulses possible to offer the investors, who want to guarantee their activity primarily in rural areas might be perceived as further restrictions towards the development of ICT. In addition, it is also necessary to introduce appropriate and relevant regulations aimed at investment in telecommunications infrastructure.

What should be also mentioned is that the system of economic incentives at the regional level does not work efficiently, especially as a result of inefficient management of financial and numerous organisational errors, including the mismatch of the development in relation to existing needs and constraints, with much restraint in supporting innovative projects at the same time. Presented in the paper critical attitude towards the development of modern telecommunication infrastructure in Poland is not aimed at negating the achievements to date. The opinion reflects only the level of knowledge on the present ICT situation and should be perceived to be an incentive to initiate further, more effective activities in this area.

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