

TERRITORIAL DIVERSIFICATION OF TECHNOLOGICAL EXCLUSION IN RURAL AREAS IN POLAND

Tomasz Śmiałowski, Piotr Jałowiecki, Tomasz Woźniakowski
Warsaw University of Life Sciences – SGGW

Abstract. During the transformation, after 1989 year Poland has developed more slowly than countries of the European Union in terms of economic and technological progress. With transformation from a centrally planned economy to a free market, the rate of development in our country increased significantly. In the literature disparities in access and ability to use of information technologies between inhabitants of urban and rural areas are often indicated. The paper presents research results on technological exclusion areas development in rural areas in terms of territorial in Poland in 1994–2012. The main data source were the results of household budget surveys developed every year and made available for consideration by the Central Statistical Office. Obtained results were complemented by an analysis of social diagnosis research results conducted every two years since 2000.

Key words: rural households, technological exclusion, territorial diversification, household budget surveys

INTRODUCTION

Toffler divided economic development into three waves. The first period was dominated by agriculture, in the second, major role was played by the industry, and the third is characterized by significant increase of information and knowledge importance, which in turn has led to domination of the service sector in the economy [Toffler 1980]. Table 1 shows the changes which underwent various dimensions of society during the transformation from the local agrarian society, in which the land ownership and human labour accounted for the richness, to the global information society in which information has become a major economic good [Dziuba 2007]. Both the modern economy and society depends not only on shared information, but also of how it is collecting and transmitting, which in turn increases its value as the product. Information as the fourth production

Corresponding author: Tomasz Śmiałowski, Faculty of Applied Informatics and Mathematics, Warsaw University of Life Sciences – SGGW, Nowoursynowska 159, 02-776 Warszawa, Poland, e-mail: tomasz_smialowski@sggw.pl

© Copyright by Warsaw University of Life Sciences Press, Warsaw 2015

factor provides the economic superiority for companies which it holds, and can use effectively [Kendall and Scott 1990, Pomykalski 2001]. Apart from obvious advantages of increasing the role of information in the economy and society, should also be given to new challenges appearing as a result of such a process. One of them is faster and faster increasing number of information both necessary and unnecessary, which creates a kind of information noise with which part of the population is unable to cope. This problem applies to a smaller dimension of information society, which is characterized by much more efficient ways of using and managing information [Juszczak 2000].

Table 1. Developmental characteristics of three types of societies

Characteristics	Agrarian society	Industrial society	Information society
Wealth	land	capital	knowledge
Main product	food	industrial products	information, data
Work	by the house	far from home	at home, teleworking
Transport	river, road	railway, highway	infostrada
Energy	human, animal	coal, steam, petrol	electricity, nuclear energy
Scale of operation	local	regional	global
Entertainment	ritual, folk	mass	domestic, interactive
Mystery	religious	political	commercial
Education	master	school	computer, e-learning

Source: Goban-Klas and Sienkiewicz [1999, pp. 54–55].

Changes were also in the structure of resources affecting the socio-economic development. Agricultural society was based mainly on land and labour, industrial society on capital and labour and the information society on knowledge and information.

INFORMATION SOCIETY DEVELOPMENT

Already in the 1990s in recommendations about information society prepared for the Council of Europe, it was noted that the States which first create the information society will gain the greatest benefits to enable them to reach the level of highly developed countries. Such countries will become a model of practice for countries where so far for various reasons (political, historical, economic) development of information society progressed slowly or related activities were ad hoc or provisional [Bangemann 1994]. In Poland, political, economic and social changes after 1989, resulted in the economic and technological development proceeded more slowly than in other EU countries. They had undoubted influence on the slower development of information society in our country. This process was slower in Poland than in the Czech Republic, and Hungary, which at the same time did efforts related to EU accession. One of the main reasons for a slower pace of formation of information society in Poland in the 1990s in comparison with other European countries were low investments to carry out research and development (R&D), which are the main factor of long-term technological progress. This also applied to re-

search on information and communication technologies. According to OECD data the average value of GERD (gross domestic expenditure on R&D) in Poland in the years 1991–1999 was 0.69%. For comparison, during the same period in Hungary, the index reached the level of 0.81%, and the Czech Republic 1.02%. The highest levels of the coefficient of GERD there were characterized by: Sweden – 3.22%, Japan – 2.85%, United States – 2.57% [OECD, Main Science and Technology Indicators].

In the first decade of the XXI century, influence earlier political system and centrally planned economic system was getting weaker, due among others the progress of a free market economy, as well as the importance of economic development and technological individual characteristics of individuals (age, sex, education, the material situation, the type of biological family, the place of household functioning, and socio-economic group) growing [Czapiński and Panek 2000–2013]. These changes resulted in a more dynamic information society development in Poland, which is reflected in the growth of the indicators for level of development of the information society [Ziemia and Żelazny 2012, Schlichter and Danylchenko 2013]:

- ICT development index (IDI) – in Poland within the last 10 years almost doubled in 2012, reaching a level of 6.31, only 0.42 below the level of developed European countries. Poland (an increase of 89%) among the countries of the European Union after Romania (up 116%), Bulgaria (an increase of 113%), Croatia (an increase of 98%) and Lithuania (an increase of 93%) is characterized by one of the fastest pace of this index change [International Telecommunication Union 2013]. Amongst 28 member countries, Poland in 2012 occupied 21st position, which meant a rise of two places compared to 2002;
- networked readiness index (NRI) – in the latest ranking of The Global Information Technology Report 2014 Poland ranked at 54th position to give a level equal to 4.2 NRI. Among the EU countries, as in the case of IDI, Poland was ranked at 22nd place (23th place compared with all European countries);
- gross domestic expenditure on R&D (GERD) – in 2002 in Poland amounted to 4,522 million acting by 0.56% of GDP. Within 10 years, their value tripled, acting 0.9% GDP in 2012. Although the rate of change was one of the highest among EU countries (EU-28) Poland in 2012, in relative terms (GDP), has spent on ICT research over twice less than most of the EU member states – the average was 2.07% of GDP. Poland in 2012 has released on research and development 3,429,855 million (11th place among EU countries), and per capita development expenses totaled only EUR 89 (24th place).

In the years 1994–2012 the systematic increase in the number of households equipped with a variety of information and communication technologies and in their spending on them have been shown [GUS 1994–2012]. On the one hand this is a result a general increase in the level of wealth of the society and the systematic decrease in the level of costs that must be incurred to obtain access to these technologies. On the other hand, one can see a growing social awareness of the benefits to be achieved as a result of their possession, as well as more often of the nature of the work, which makes it not only at work, but also in his private life must have access to appropriate technological solutions [Śmiałowski and Jałowicki 2012]. Possession and using modern information and com-

munication technologies is currently a source of competitive advantage in terms of both macroeconomic and microeconomic [European Commission 2010, GUS 2004, 2013b].

Apart from the obvious advantages brought by technological progress in developed and developing countries also it began to observe the phenomenon of inequality in access to ICT, which was described as different types of exclusions. In the literature, mostly can be found up with the term “digital exclusion” concerning the division of society due to the possession and use of the Internet, computer, and mobile phones [Chinn and Fairlie 2004]. On the one hand, the term “digital indicates” to take into account in studies latest ICT solutions, on the other it reduces the area of analysis excluding analog technologies so prevalent until recently. Therefore, in the studies it was used an technological exclusion term defined as the division of society into those who in their households do not have or do not use regularly both kinds of technologies, digital and analog. Technological exclusion phenomenon is also present in Polish society, and now its scale is one of the main indices used to assess the degree of technological, social and economic advancement of the state.

Władysław Grabski already in the 1920s, pointed out that the economic, social and political development in Poland depends on eliminating the problems at rural areas. He claimed that “for the general progress of society, for its strength in national and state, for social and civilizational improvement, it is necessary that the general rural population had a high degree of economic independence and its environment should be an significant amount of the population capable of knocking out ahead” [Grabski 2004].

While for almost 100 years conditions in which rural households functioning changed diametrically, the main concepts presented by Grabski did not lost much in the news. The problems of educational opportunities for rural youth or economic efficiency of rural households are still actual. In addition, agriculture has to face the new challenges of the implementation of new technologies, including diminishing the technological exclusion problem.

THE AIM AND PURPOSE OF STUDIES

Research on the digital exclusion, performed in Poland so far focused mainly on the analysis of access, possession and using of information and communication technologies, such as mobile phones, computers and Internet connection for the main social, economic or demographic [Czapiński and Panek 2000–2013, Sobocka-Szczapa 2011]. In the literature technological exclusion of rural households was mostly analyzed only at a national level, or in some regions, for example in Mazowieckie voivodeship [Czapiński and Panek 2000–2013, GUS 2004, 2013a]. There is a lacks of cross-sectional studies focusing on digital and analog exclusions in different groups of rural households and analyzing the processes of its changes in time. One of the main factors determining technological exclusion phenomenon is the household functioning place [Czapiński and Panek 2000–2013, GUS 2004, 2013a].

The aim of the study was to identification of areas of technological exclusion and their diversification in rural areas in terms of territorial in Poland in the years 1994–2012. Presentation of complete image required a comparison of the results with the corresponding

information for the various categories of the size of cities and all of the villages and towns at the same time. The paper presents only the aspects of equipment of rural households in: computer, Internet connection, mobile phone and so traditional technologies (TV, satellite or cable TV, landline phone and a radio). Rural households were understood as households located in rural areas.

To assess the scale of technological exclusion of rural households used the so-called possession each technology factors, which was defined as the percentage of rural households with access to the technology in the total number of rural households in the voivodeship [Śmiałowski and Jałowicki 2012]. All results are presented on the maps taking into account an administrative division existed in Poland since 1998. Thus, for data from the years 1994–1998, there was necessary to make the conversion of 49 “old” to 16 “new” provinces with using of towns and villages categories structure and Monte Carlo simulations in accordance with the method described by Śmiałowski and Jałowicki [2013]. In the case of Internet and mobile phones possession, GUS collected information since 2000, and therefore on the charts of these two technologies only data for the years 2000–2012 are presented. Due to the readability charts presenting the coefficient of connection to the Internet and mobile phones possession, presents only the results of even-numbered years, while the other two shows the results of every three years. To analyze the dynamics of changes of studied coefficients the average rate of change (ARC) calculated according to formula (1) was used.

$${}^{n-1}\sqrt{\frac{x_n}{x_1}} \quad (1)$$

For all studied technologies, voivodeships has been divided into four groups according to the method by Nowak [Nowak 1990]. Affiliation to particular groups was determined on the basis of formulas (2), (3), (4) and (5). In the Figures 1–4, darker colors mean group of voivodeships characterized by higher values of studied coefficients.

$$\text{group I } [\min x, \bar{x} - s(x)] \quad (2)$$

$$\text{group II } [\bar{x} - s(x), \bar{x}] \quad (3)$$

$$\text{group III } [\bar{x}, \bar{x} + s(x)] \quad (4)$$

$$\text{group IV } [\bar{x} + s(x), \max x] \quad (5)$$

In studies, a primary data source was the results of Household Budgets Survey (BGD) conducted annually by the Polish Central Statistical Office (GUS). They contain detailed characteristics of more than 30 thousand households and approximately 100 thousand people in every year. These data concern economic, social, territorial, and demographic characteristics, as well as structure of incomes, expenditures and household equipment. The results are complemented by socio-economic information derived from social diagnosis panel research conducted since 2000, and since 2003 he has regularly every two years. The sample during 13 years has more than quadrupled from 3,005 households in 2000 to 12,355 in 2013 covering over 36 thousand people. Source data have been processed and aggregated into an unified database, forming the basis for further studies.

RESULTS

In Poland in the years 1994–2012 the percentage of rural households equipped with a PC in all voivodeships continued increasing trend (see Fig. 1). An analogous growing trend was seen both in the case of other classes of the town as well as a total of all rural households in different voivodeships. In 1994, a group which have the highest values of the coefficient of having PC included rural households of Zachodniopomorskie (7.4%) and Opolskie (7.2%) voivodeships. The groups with the lowest percentage of rural households accounted for Lubelskie (0.8%) and Podkarpackie (0.9%) voivodeships. In the 18 years the structure of both groups changed significantly. In the first group, in 2012 there were rural households of Wielkopolskie (71.5%) and Pomorskie (70.4%) voivodeships, while in the second of Podlaskie (53.8%), Warmińsko-Mazurskie (54.4%) and Łódzkie (57.6%) voivodeships. The fastest development of rural households in terms of PC possession were in those that existed in Podkarpackie ($ARC_{1994-2012} = 37\%$), Lubelskie ($ARC_{1994-2012} = 36\%$) and Mazowieckie ($ARC_{1994-2012} = 32\%$) voivodeships, and the slowest were in Zachodniopomorskie and Opolskie (both $ARC_{1994-2012} = 17\%$).

With the increase the level of computerization of rural households also increased the number of households with Internet connection (Fig. 2). In 2000, the highest value of the possession coefficient among rural households was observed in Opolskie (3.3%) voivodeship, whereas the lowest in Łódzkie (0.9%) and Pomorskie (0.9%) voivodeships.

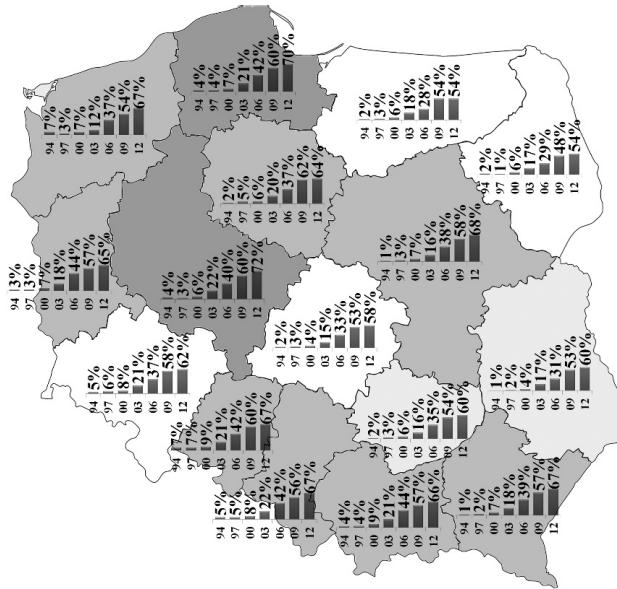


Fig. 1. The percentage of rural households equipped with a PC in the years 1994–2012 in different voivodeships and their classification due to the average size of this share during the period considered (darker colour indicates a higher average share)

Source: Own preparation on the basis of GUS data from Households Budgets Survey 2012 [GUS 1994–2012].

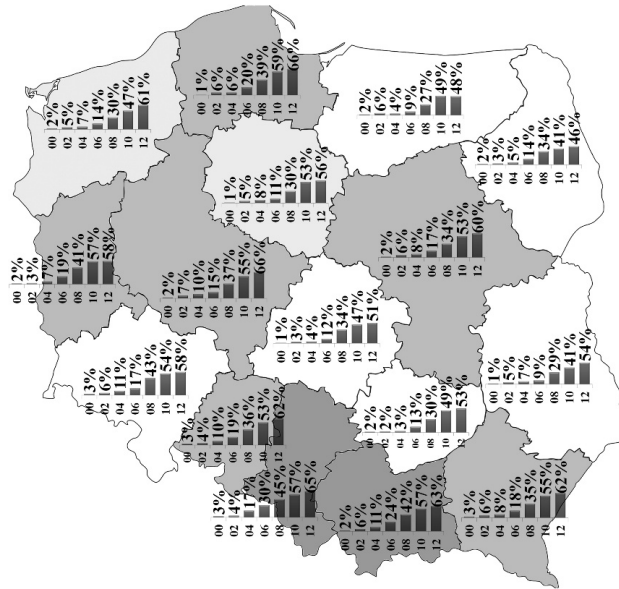


Fig. 2. The percentage of rural households equipped with an Internet connection in the years 2000–2012 in different voivodeships and their classification due to the average size of this share during the period considered (darker colour indicates a higher average share)

Source: Own preparation on the basis of GUS data from Households Budgets Survey [GUS 1994–2012].

In 2012, the highest coefficient values were found in Wielkopolskie (66.2%), Pomorskie (66%) and Śląskie (65%) voivodeships, and the lowest in Podlaskie (46.4%) and Warmińsko-Mazurskie (48.2%) voivodeships. Among surveyed technologies, the most dynamic increase of possession factor was connected to the Internet. The fastest development of rural households were those in: Pomorskie ($ARC_{2000-2012} = 43\%$), Lubelskie ($ARC_{2000-2012} = 40\%$) and Łódzkie ($ARC_{2000-2012} = 40\%$) voivodeships, while the slowest in: Opolskie ($ARC_{2000-2012} = 28\%$), Dolnośląskie ($ARC_{2000-2012} = 29\%$), and Podkarpackie ($ARC_{2000-2012} = 29\%$) voivodeships.

In the period from 2000 to 2012 the number of rural households equipped with a mobile phone has increased several times (Fig. 3). Since 2008, the gradual saturation of households by this technology has visible, which results in slowing down the growth of such rural households number. In the first year of the study by far the largest share of rural households equipped with this technology, fell on Lubuskie (17.4%) and Pomorskie (17.1%) voivodeships, and the lowest on Lubelskie (5.9%) and Podkarpackie (6.5%) voivodeships. After 12 years, a group of rural households characterized by the highest levels of the coefficient of holding mobile phones accounted for Wielkopolskie (95.3%), Pomorskie (93.7%) and Mazowieckie (93.7%) voivodeships, while the smallest for Podlaskie voivodeship (81.7%). Analysis of dynamics of changes in coefficient value showed the fastest growth in the regions of Lubelskie ($ARC_{1994-2012} = 24\%$) and Podkarpackie ($ARC_{1994-2012} = 25\%$) voivodeships, and the slowest in Lubuskie ($ARC_{1994-2012} = 15\%$) and Pomorskie ($ARC_{1994-2012} = 15\%$) voivodeships.

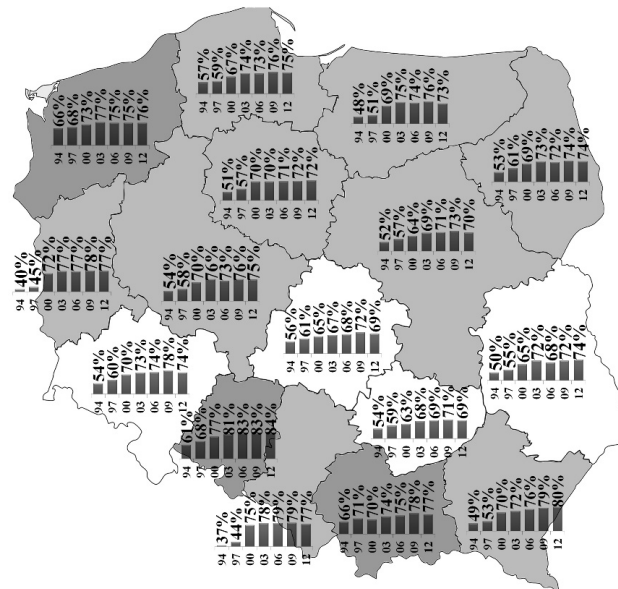


Fig. 4. The percentage of rural households equipped with traditional technologies in the years 1994–2012 in different voivodships and their classification due to the average size of this share during the period considered (darker color indicates a higher average share)

Source: Own preparation on the basis of GUS data from Households Budgets Survey [GUS 1994–2012].

Classification of rural households in each voivodships according to the average value of coefficient ownership of selected technologies in the years 1994–2012 coincides with the results of specific research equipment of rural households in these technologies and their dynamics of changes over time. In the matter of computers, mobile phones and Internet connection possession a slight difference between the eastern and western provinces in favor of the latter is noticeable. In particular, north-eastern area of Poland was characterized by the lowest values of these three technologies possession coefficients. In the case of traditional technologies, as a result of the classification, rural households in particular voivodships were to classify only into three groups, due to the fact that no voivodship was included in the second group. It resulted from high stratification of owned technologies.

CONCLUSIONS

Access and skills to use of modern ICT technologies are now *sine qua non* condition of full participation in the modern information society life. The results indicate a systematic increase in the analyzed period, the number of rural households equipped with different types of ICT. This was due to both the increase in the wealth of rural households with a decline in the cost of ownership of ICT, as well as with increasing benefits from their possession and use every day. Within 18 years, access to all of the analyzed

categories of ICTs, was characterized by a positive trend. In the case of modern ICT technologies (computer, internet, mobile phone) changes from 1994 to 2012 can be compared to the period between birth and obtaining a maturity. In most voivodeships throughout the analyzed period, year after year a systematic increase the value of each technology possession coefficient. After 2008 year, only in Kujawsko-Pomorskie, Świętokrzyskie and Warmińskie-Mazurskie voivodeships short-term and one-time decrease the share of rural households equipped with a mobile phone and a computer were observed. In addition in Podlaskie voivodeship it was also connected with Internet possession. Analysis of equipment of rural households and the dynamics of its changes indicates the presence of strong relationship between having a computer and Internet connection. By far the most developed regions in terms of access to modern ICT technologies were rural areas in Pomorskie and Wielkopolskie voivodeships. In terms of rural households equipment with a computer and Internet access, the leading are Małopolskie and Śląskie voivodeships, in the case of the only computer itself Opolskie voivodeship, and in the case of mobile phones even Kujawsko-Pomorskie voivodeship. Dolnośląskie, Podlaskie and Lubelskie were areas in which the lowest percentage of rural households equipped with all studied modern ICT were identified. Łódzkie, Świętokrzyskie and Warmińsko-Mazurskie voivodeships supplement this group with regard to the connection to the Internet and PC possession, and Podkarpackie voivodeship for mobile phone possession.

In the near future should be also expect that, while in subsequent years the number of rural households equipped with a computer and internet connection will continue to grow rapidly, in the case of mobile phones as a result of saturation index values will be having oscillated around the level of 90%. In the case of traditional technology since the middle of the first decade of XXI century there is a noticeable stabilization of the percentage of rural households equipped with these technologies. Only in Dolnośląskie, Kujawsko-Pomorskie, Lubuskie and Świętokrzyskie voivodeships were impermanent downward trends or growth. Voivodeships, which were dominated by traditional technologies, are Małopolskie, Opolskie and Zachodniopomorskie. The lowest advancement level were characterized rural households from Lubelskie, Łódzkie, Świętokrzyskie and Dolnośląskie voivodeships. In the next years, however should be expected a slow decline of the importance of technologies at the expense of traditional ICT technologies, like all households in particular voivodships

REFERENCES

- Bangemann, M. (1994). Europe and the Global Information Society. Bangemann report recommendations to the European Council, Brussels.
- Chinn, M., Fairlie, R. (2004). The Determinants of the Global Digital Divide: A Cross-Country Analysis of Computer and Internet Penetration. Economic Growth Center, Yale University.
- Czapiński, J., Panek, T. (2000–2013). Diagnoza społeczna. (Social Diagnosis). Ministerstwo Pracy i Polityki Społecznej, Warszawa.
- Dziuba, D.T. (2007). Metody ekonomiki sektora informacyjnego. (Economics methods of the information sector). Difin, Warszawa.

- Goban-Klas, T., Sienkiewicz, P. (1999). Społeczeństwo informacyjne: Szanse, zagrożenia, wyzwania (Information Society: Opportunities, threats, challenges). Wyd. Fundacji Postępu Telekomunikacji, Kraków.
- Grabski, W. (2004). Historia wsi w Polsce. (History of the village in Poland). Wydawnictwo SGGW, Warszawa.
- GUS (1994–2012). Budżety Gospodarstw Domowych. (Household budget surveys). Warszawa.
- GUS (2004–2013a). Społeczeństwo informacyjne w Polsce. Wyniki badań statystycznych z lat 2004–2008 oraz 2009–2013. (Information Society in Poland. Research results of years 2004–2008 and 2009–2013). Warszawa.
- GUS (2004–2013b). Wykorzystanie technologii informacyjno-(tele)komunikacyjnych w przedsiębiorstwach i gospodarstwach domowych w latach 2004–2013. (The use of information and communication technology (tele)communication in businesses and households in the years, 2004–2013). Warszawa.
- International Telecommunication Union (2013). Measuring the Information Society, Geneva.
- Juszczyk, S. (2000). Człowiek w świecie elektronicznych mediów – szanse i zagrożenia. (The man in the world of electronic media – opportunities and threats). Wydawnictwo UŚ, Katowice.
- Kendall, W.R., Scott, R. (1990). Information As a Factor of Production. *Journal of Information Technology Management*, I(2), 39–43.
- European Commission (2010). Europe 2020 – A European strategy for smart, sustainable and inclusive growth, Brussels.
- Nowak, E. (1990). Metody taksonomiczne w klasyfikacji obiektów społeczno-gospodarczych. (Taxonomic methods in the classification of socio-economic objects). PWE, Warszawa.
- Pomykański, A. (2001). Zarządzanie innowacjami. (Innovation management). Wydawnictwo Naukowe PWN, Warszawa-Lódź.
- Schlichter, B.R., Danylchenko, L. (2013). Measuring ICT usage quality for information society building. *Government Information Quarterly*.
- Sobočka-Szczapa, H. (2011). Wykluczenie cyfrowe na Mazowszu. Wyniki badań. (The digital divide in Mazovia. Research results). Warszawa.
- Śmiałowski, T., Jałowiecki, P. (2013). Symulacyjne metody transformacji danych pochodzących z wyników badań budżetów gospodarstw domowych pomiędzy podziałami Polski na województwa. (Simulation methods for data transforming between administrative divisions in Poland). *Roczniki Naukowe SERiA*, XV, 5.
- Toffler, A. (1980). *The Third Wave*. Morrow, London.
- Ziemia, E., Żelazny, R. (2013). Measuring information society – addressing key issues and constraints. *Business Informatics*, 2(28), 170–193.

TERYTORYALNE ZRÓŻNICOWANIE WYKLUCZENIA TECHNOLOGICZNEGO NA OBSZARACH WIEJSKICH W POLSCE

Streszczenie. W okresie transformacji, po 1989 roku Polska w zakresie gospodarczego i technologicznego postępu, rozwijała się wolniej niż państwa Unii Europejskiej. W wyniku transformacji z gospodarki centralnie planowanej do wolnorynkowej, tempo rozwoju w naszym kraju znacznie wzrosło. W literaturze często wskazywane są dysproporcje między mieszkańcami obszarów miejskich i wiejskich w zakresie dostępu i umiejętności wykorzystywania technologii informacyjnych. W pracy przedstawiono wyniki badań na temat rozwoju obszarów wykluczenia technologicznego na obszarach wiejskich w przekroju terytorialnym w Polsce w latach 1994–2012. Głównym źródłem danych były wyniki badań budżetów gospodarstw domowych przeprowadzanych co roku i udostępnianych odpłatnie

przez Główny Urząd Statystyczny. Dane te zostały uzupełnione o analizę wyników badań diagnozy społecznej przeprowadzanych cyklicznie co dwa lata począwszy od 2000 roku.

Słowa kluczowe: gospodarstwa wiejskie, wykluczenie technologiczne, zróżnicowanie terytorialne, badania budżetów gospodarstw domowych

Accepted for print: 10.02.2015