

ECONOMIC CONTEXTS OF DIFFERENCES IN DIGITAL EXCLUSION

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ABSTRACT

In the 21st century, the problem of digital divide is more and more dynamic. Lack of access to digital technology is now the same exclusion as once slavery, lack of access to education or to work. The paper presents the results of research on the impact of belonging to a socio-economic group and income on a scale and diversity of the digital divide of Polish households in 2003–2015. Author's digital divide indicator was used to assess the impact. In the analyzed period, the scale of digital divide is gradually decreasing, however, its level depends on the socio-economic group and the income. From all socio-economic groups only in the group of students the digital exclusion as marginal. However, the phenomenon of digital divide was the most noticeable among the groups of farmers, pensioners and retirees – almost 80% of people from these groups were excluded or at risk of digital divide. In the case of the second analyzed factor, the research has shown that with the increase in income, the scale of digital divide and its diversification were getting smaller.

Key words: ICT, income, socio-economic groups, inequalities, multidimensional data analysis

JEL codes: O33

INTRODUCTION

The development of information society caused that in Poland, as in other countries, modern information and communications technologies (ICTs) became an integral part of the functioning of both businesses as well as the society. The lack of clear boundaries in the use of ICTs in professional life and in private life, leads to a difficulty in estimating direct relationships between the development of information and communications technologies and the development of the economy. An additional problem in the accurate assessment of the influence of ICTs on the economy is the lack of a uniform methodology that would be established and accepted by all, which can be confirmed by the results of analyses performed so far. According to different estimates, in Poland, the ICTs are responsible for generating from 1.6 to 7.9% of GDP. The Boston Consulting Group (BCG), using the expenditure method, which

measures GDP as the sum of domestic demand and the balance of trade, estimated that the internet economy in Poland in 2009 generated PLN 35.7 billion, which was 2.7% of GDP [Cimochowski et al. 2011]. Deloitte, which uses in its research a method including the areas of the economy, in which the Internet played a significant role: corporate sector (66.6%), public sector (18.8%), finance and insurance sector (14.6%), estimated that in 2010 the share of ICT in generating GDP in Poland was 4.8% or PLN 68 billion. This means that it doubled within the period of the last five years [Deloitte 2012]. According to research funded by the European Commission's Future Internet Public Private Partnership (FI3P), taking into account the Internet sector only, in 2010 the share of the internet economy in GDP was 1.6% or PLN 24 billion, being one of the lowest in the European Union, where the average was 4.1%. As a cause for this situation, authors of the report pointed out an "old" structure of the economy,

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in which the gross value added of the production and main sectors (together with agriculture) was 32%, while for the countries of the EU-27 it was at a level of 24% [Hoorens et al. 2012]. However, analyses and forecasts of the Polish Ministry of Economy indicate that the share of the ICT sector in 2013 was 7.9% of GDP, and that in the coming decade it is to increase to a level of 15% [MG 2014].

Changes resulting from the popularization of information and communications technologies in the economy are also noticeable in households. In the years 1994–2015 the number of households equipped in various information and communications technologies grew dynamically [Śmiałowski and Jałowicki 2012]. It was a result of a general increase in the level of wealth of the society and of a systematic decrease in costs, which had to be covered in order to gain access to these technologies. The expenditures on ICT and related services grew systematically in the years 1994–2015, both in the case of particular socio-economic groups, as well as for all households together. However, the level of spending was different for each of the socio-economic groups. The largest share of ex-

penditures on ICT and related services was associated with self-employed households, and the smallest with farmers. The shares of expenditures on ICT out of the total, associated with the households of retirees and disability pension recipients, were the closest in terms of their size (Fig. 1).

Digital exclusion is among the most important consequences. Any exclusion leads to inequality and marginalization of a part of the society, in which it exists [Deaton 2013]. An aspect of digital exclusion, which is worthy of pointing out, is the lack of negative effects resulting from belonging to the digital exclusion sphere at first [Czapiński and Panek 2007]. The main reason is that the awareness of the need of using cutting-edge technologies is very low. This situation changes under certain circumstances, particularly at the moment of losing an old job and searching for a new one, or in cases of changing workplace conditions, which is related to the implementation of the modern ICT.

The development of civilization towards the information society causes that digital exclusion starts to be felt not only by individuals, but also on the scale of

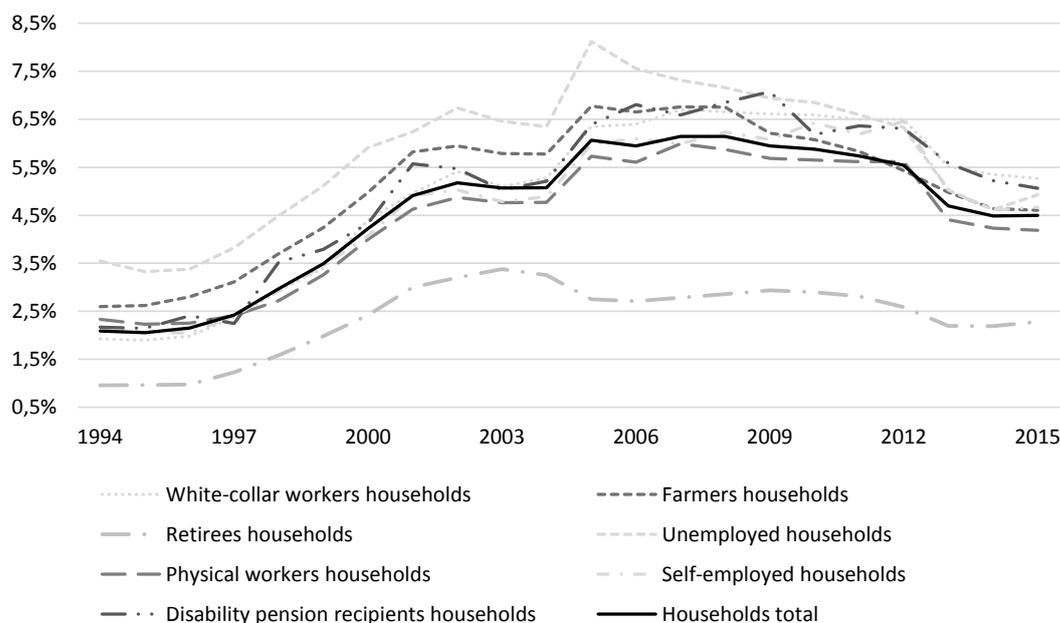


Fig. 1. Share of expenditures on ICT and related services in households total and in division on socio-economic groups
Source: Own preparation on the basis of GUS [1994–2015].

the whole country [GUS 2015, 2016]. Poland as a nation, represented by the government of the country, seeing the great potential of the information society, made it one of the goals for the current national policy [MSWiA 2008].

The goal of this article is to make an assessment of the influence of the economic conditions on the scale of and differences in digital exclusion of Polish households. Digital exclusion was defined in this research as “the differences between persons, households, companies and geographical areas on different socioeconomic levels, both with regard to their chances for access to information and communications technologies as well as the use of the technologies on the Internet for a wide range of activities” [OECD 2001].

MATERIAL AND METHODS

The implementation of the research goal, which was set forth, required identifying the economic factors that influence the scale of digital exclusion. An analysis of the literature and main data sources: the Social Diagnosis reports and the Statistics Poland (GUS) research results, pertaining to household budgets, allowed to determine two most important factors: belonging to a socio-economic group and income.

In the case of the first factor, a division into seven main socio-economic groups (SEGs) was accepted as the basis for the research being performed: employees (SEG 1), private entrepreneurs (SEG 2), farmers (SEG 3), disability pension recipients (SEG 4), retirees (SEG 5), students and college students (SEG 6) and the unemployed and other persons who are professionally inactive (“out of the workforce”) (SEG 7) [Czapiński and Panek 2003–2015, GUS 2003–2015]. In the case of the second factor under analysis, a classification was accepted including three income groups (ICGs). The first group were persons, whose income did not exceed the minimum wage (ICG 1); the second group were persons, whose income was above

the minimum wage, but did not exceed the national average (ICG 2); the third group were persons, whose income was above the national average (ICG 3)¹. The grouping of persons according to the above income classification significantly helped to decrease the concentration of income around low values², in comparison to the empirical distribution of income³. In order to use variables easily, all variables were labeled with an abbreviated name constructed of two elements: a three-letter symbol of the variable and a number standing for the category of the variable.

The research on the level of and differences in the spheres of digital exclusion was divided into the four phases:

- determination of the digital exclusion index for every person, who is more than 14 years old, and an initial statistical analysis of the level of digital exclusion for the particular economic factors;
- verification of the statistically significant relationship between the degree of digital exclusion and the economic factor or its lack, with the chi-squared test of independence [χ^2 test] and the Pearson’s contingency coefficient [Koronacki and Mielniczuk 2006];
- evaluation of the degree of differences in digital exclusion for the particular economic factors based on the Gini coefficient [Anand 1983, Dudek 2006] and the determination of the structure of differences with the use of the Theil index [Theil 1967, Jabkowski 2009];
- identification of interrelationships of differences between the degree of digital exclusion and the economic factor using the grade correspondence analysis (GCA, GCCA) [Szczesny 2002, Kowalczyk et al. 2004].

The evaluation of the level of and differences in digital exclusion was performed over two-year periods due to the nature of the data. The choice of a two-year period was related to the data collection method for the Social Diagnosis reports.

¹ Changes in the minimum wage amount and in the national average amount in particular years were taken into account in this research. There were two different minimum wage amounts in 2007, that is why an amount being their arithmetic average was used in this paper to be the minimum wage reference level.

² Skewness from 0.20 to 0.46; kurtosis from –0.71 to –0.87.

³ Skewness from 3.52 to 5.73; kurtosis from 12.33 to 55.67.

In the first phase of the research, for every adult person the level of digital alienation was calculated based on the digital exclusion index [Śmiałowski 2018], according to the following formula:

$$wwc_j = \sum_{i=1}^n w_i \cdot x_{ij} \quad (1)$$

where:

x_{ij} – value of the i -th characteristic for the j -th observation;

w_i – the i -th characteristic.

Next, depending on the level of the digital exclusion index, every adult person was classified as belonging into one of four groups, according to the division method (2) (3) (4) (5) proposed by Nowak [1990]:

– DEG I – a person who is digitally excluded:

$$[\min wwc, \overline{wwc} - s(wwc)] \quad (2)$$

– DEG II – a person endangered with digital exclusion:

$$[\overline{wwc} - s(wwc), \overline{wwc}] \quad (3)$$

– DEG III – a person somewhat using the latest ICT solutions:

$$[\overline{wwc}, \overline{wwc} + s(wwc)] \quad (4)$$

– DEG IV – a person fully benefitting from using the latest ICT solutions:

$$[\overline{wwc}, s(wwc), \max wwc] \quad (5)$$

The obtained results were used to calculate the percentage shares of digital exclusion groups in the particular categories of a given differentiating factor according to the formula:

$$y_j = \frac{x_i}{\sum_{i=1}^4 x_i} \quad (6)$$

where:

x_i – the number of persons in the i -th group of digital exclusion in the j -th category;

$\sum_{i=1}^4 x_i$ – the total number of persons in the j -th category.

The calculated percentage shares were the basis for creating for both economic factors a table containing the profile of digital exclusion groups in subsequent years. Next, the average value of the characteristics analyzed in the research period was found based on the chronological average [Witkowska 2001, Sobczyk 2007]:

$$\bar{y} = \frac{1}{n+1} \sum_{t=1}^n y_t \quad (7)$$

where:

y_t – value of the researched characteristic in year t ;

n – number of years.

RESEARCH RESULTS

The research, which was performed, showed that a socio-economic group affiliation as well as an income group affiliation both had a considerable influence on the level of and differences in digital exclusion. The obtained results were also confirmed by the analysis of relationships between the digital exclusion group association and the association with the groups determined based on the investigated differentiating factors. The analysis showed that both economic differentiating factors were statistically significant. The average value of the contingency coefficient for a socio-economic group was 0.427, and for an income group it was 0.170.

College and other school students were the only group out of all socio-economic groups, which was definitely dominated by persons who fully took advantage of the latest ICT solutions (the average value of the level of digital exclusion was 51.9% – Table 1). At the same time, the students were the only group characterized by a small share of digitally excluded persons (8.2%). On the other hand, digitally excluded persons were a group that definitely dominated (from 68.7 to 77.4%) among farmers, retirees, and disability pension recipients. The remaining exclusion groups (DEG II, DEG III, DEG IV), existing among farmers, disability pension recipients and retirees, were characterized by a small share in the digital exclusion profile. It was observed that only in the group of the unemployed and other professionally inactive persons the digital exclusion profile was similar to the general profile (determined for all persons).

Table 1. Digital exclusion profile in individual socio-economic groups in 2003–2015

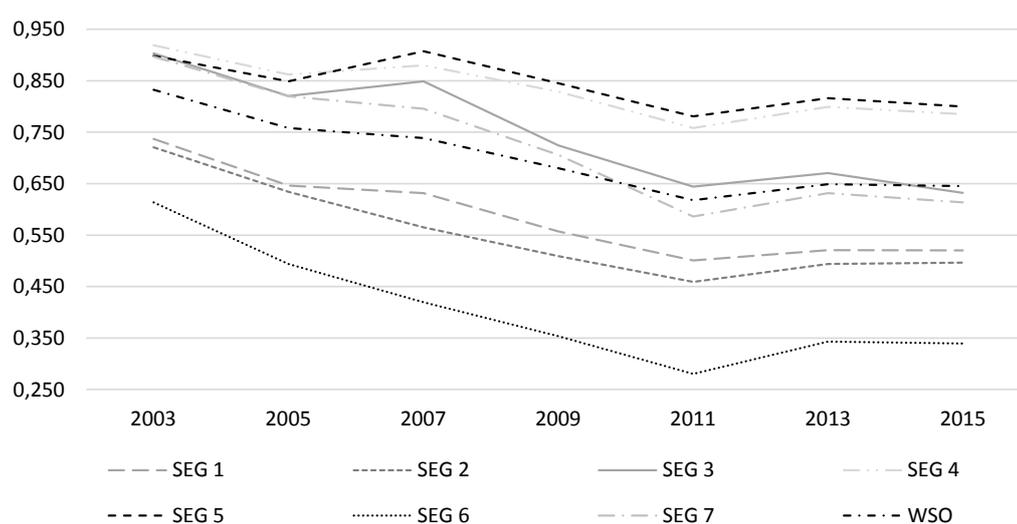
Socio-economic group	Average level of exclusion (%)						
	2003	2005	2007	2009	2011	2013	2015
DEG I	32.0	26.1	68.7	71.7	77.4	8.2	54.5
DEG II	13.4	14.8	9.7	5.1	4.1	11.7	11.3
DEG III	10.7	12.4	4.7	3.8	2.3	15.7	7.4
DEG IV	31.4	34.3	4.4	6.9	3.6	51.9	14.3

Source: Own preparation on the basis of Czapiński and Panek [2003–2015].

The domination of digitally excluded persons in particular socio-economic groups significantly influenced the level of differences in digital exclusion (Figs. 2 and 3). The group of college and other school students was characterized by definitely the smallest differences in digital exclusion (the average value of the Gini coefficient was 0.355). Entrepreneurs (0.485) and employees (0.514) were characterized by greater differences than the student group, although the differences were clearly smaller than differences for all persons overall (0.615). The unemployed and other professionally inactive persons (0.631) and farmers (0.623) were the groups for which the level of differ-

ences was closest to the level of differences for the whole population of the country. Definitely the greatest differences were observed in the group of disability pension recipients (0.729) and retirees (0.737).

The breakdown of the overall scheme of differences in digital exclusion in the investigated socio-economic groups revealed that definitely the greatest percentage shares in the overall differences belonged to the group of employees (29.6%) and the inter-group differences (24.2%). The unemployed and other professionally inactive persons (10.3%) and retirees (8.1%) were characterized by significantly smaller shares. Definitely the smallest shares belonged to the groups of farmers



WSO – total number of persons.

Fig. 2. The trend of dispersion of digital exclusion in particular socio-economic groups in 2003–2015

Source: Own preparation on the basis of Czapiński and Panek [2003–2015].

(2.0%), entrepreneurs (3.3%), disability pension recipients (4.5%) and students (5.5%).

The analysis of the overrepresentation map (Fig. 3) confirmed that substantial differences in the level of digital exclusion existed in all socio-economic groups. The groups of digitally excluded persons were characterized by a greater, in comparison to the average socio-economic structure, share of retirees, farmers, disability pension recipients, the unemployed and other professionally inactive persons, and by a smaller share of the groups of employees, entrepreneurs, students. The groups of persons fully taking advantage of the latest ICT solutions were characterized by an inverse relationship, that is, a smaller, in comparison to the average socio-economic structure, share of retirees, farmers, disability pension recipients, the unemployed and other professionally inactive persons, and by a greater share of employees, entrepreneurs, students. The digital exclusion groups: second and third, had the socio-economic structures similar to the group of persons fully taking advantage of the latest ICT solutions.

The research on the level of digital exclusion in socio-economic groups, performed with the use of the grade correspondence analysis, also revealed the existence of certain similarities between these groups. Four

main categories were identified: the first – which consisted of retirees and farmers; the second – which consisted of disability pension recipients, the unemployed and other professionally inactive persons; the third – which consisted of employees, entrepreneurs; the fourth – which consisted of college and other school students. In the case of digital exclusion groups, the performed analysis allowed to identify three main categories: the first – which consisted of digitally excluded persons; the second – which primarily included persons belonging to the second and the third group of digital exclusion; the third – dominated by persons fully taking advantage of the latest ICT solutions.

The second discussed economic factor that influenced the differences in the level of digital exclusion, is the association with an income group. The performed research showed that along with an increase in income the share of the group of digitally excluded persons (DEG I) in the profile of exclusion was decreasing, while the share of the group of persons fully taking advantage of the latest ICT solutions (DEG IV) was increasing (Table 2). The highest levels of digital exclusion were observed in the first income group (the average value of the level of exclusion was 53.5%) and in the second income group (51.2%). In the first

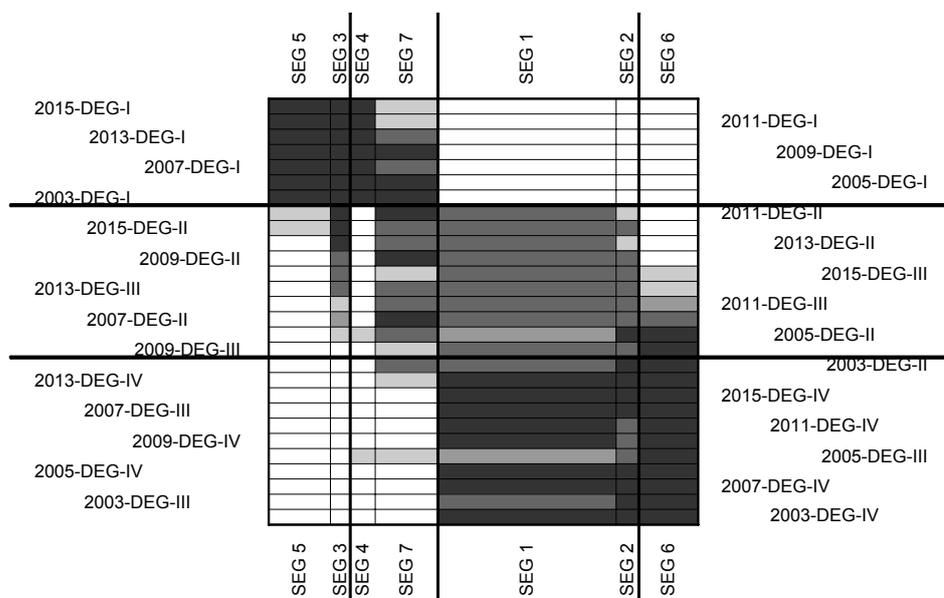


Fig. 3. Overrepresentation map of the socio-economic structure in the groups of digital exclusion in the years 2003–2015

Source: Own elaboration on the basis of Czapiński and Panek [2003–2015].

Table 2. Digital exclusion profile in individual income groups in 2003–2015

Socio-economic group	Average level of exclusion (%)		
DEG I	53.5	51.2	28.8
DEG II	8.9	10.3	12.0
DEG III	7.4	7.6	10.2
DEG IV	17.7	18.4	36.5

Source: Own elaboration on the basis of Czapiński and Panek [2003–2015].

two income groups, the group of persons fully taking advantage of the latest ICT solutions represented a definitely lower percentage (17.7 and 18.4%, respectively), and the two remaining digital exclusion groups represented the lowest percentage. In the highest income group, the group of persons fully taking advantage of the latest ICT solutions had the largest share in the digital exclusion profile (36.5%). Next, the percentage share of the digitally excluded persons was smaller (28.8%). Two remaining digital exclusion groups, similarly as in the first and the second income group, were characterized by the smallest share.

The research on the differences in digital exclusion in the income groups, similarly as in the case of socio-economic groups, showed that the share of excluded persons significantly influences the level of differences (Figs. 4–5). The differences in digital exclusion in the successive income groups and years were getting smaller. Definitely the smallest differences in digital exclusion characterized the highest income group (the

average value of the Gini coefficient was 0.498). The differences in digital exclusion were clearly smaller than the differences in the income group: the first (0.638) and the second (0.623) and for all persons together (0.615). The overall differences were influenced the most by the two first income groups (32.7% and 39.4%, respectively). The highest income group was characterized by a significantly smaller share in the total differences in digital exclusion (11.9%). The shares of differences between groups (3.5%) were definitely the smallest.

The evaluation of overrepresentation (Fig. 5) confirmed that substantial differences in the level of digital exclusion existed in all income groups. The groups of digitally excluded persons were mostly characterized by a greater, with regard to the average structure of income, share of the first income group and a smaller share of the third income group. The groups of persons fully taking advantage of the latest ICT solutions were characterized by an inverse relationship, that is,

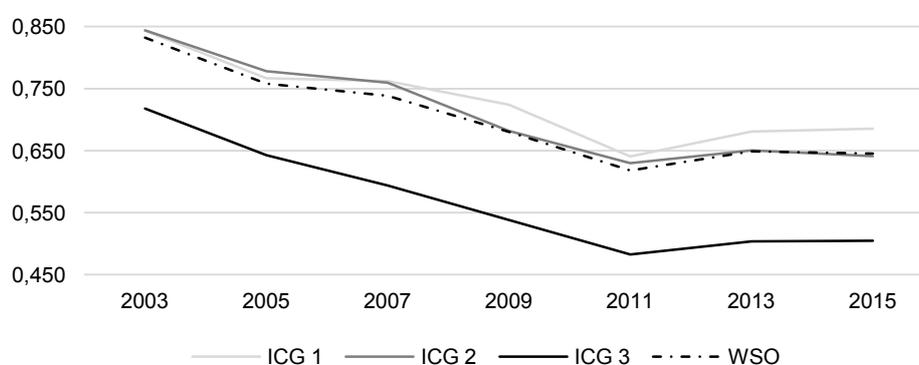


Fig. 4. The trend of digital exclusion dispersion in particular income groups in the years 2003–2015

Source: Own preparation on the basis of Czapiński and Panek [2003–2015].

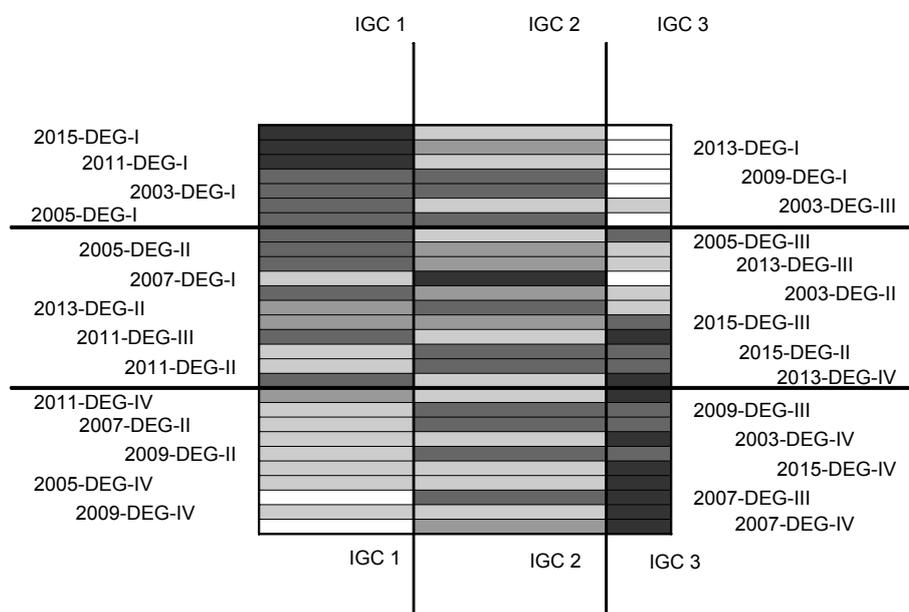


Fig. 5. Overrepresentation map of income structure in digital excluded groups in years 2003–2015

Source: Own elaboration on the basis of Czapiński and Panek [2003–2015].

a smaller, with respect to the average structure of income, share of the first income group and a greater share of the third income group. The typical relationships were not observed in the second and the third group of digital exclusion.

The research on the level of digital exclusion in income groups with the help of the grade correspondence analysis also showed the lack of similarities between these groups. In the case of digital exclusion groups, similarly as in the socio-economic groups, the performed analysis allowed to separate three main categories: the first – which mostly consisted of digitally excluded persons; the second – which primarily included persons belonging in particular years of the research to the second and the third group of digital exclusion; the third – dominated by persons fully taking advantage of the latest ICT solutions.

CONCLUSIONS

The conducted research has shown that digital exclusion affects every socio-economic group and every income group. College and other school students were the only group out of all socio-economic groups, in which the

phenomenon of digital exclusion existed to a marginal degree. Barely every fifth person in this group was digitally excluded or endangered with digital exclusion. On the other hand, the phenomenon of digital exclusion was most noticeable among farmers, retirees, and disability pension recipients – nearly 80% of persons in these groups were excluded or endangered with digital exclusion. In the case of the second economic factor, the obtained results showed that along with an increase in income the scale of digital exclusion was decreasing. The research also revealed that for both investigated factors certain similarities existed between digital exclusion groups. Three main categories were identified: the first – which mostly consisted of digitally excluded persons; the second – which primarily included persons belonging in particular years of the research to the second and the third group of digital exclusion; the third – dominated by persons fully taking advantage of the latest ICT solutions.

The obtained research results had their reflection in the level of differences in digital exclusion. Digital exclusion, however, still remains at a high level in spite of the successive decreasing. The domination of the group of excluded persons in the profile of digital

exclusion, and also the large share of the group of persons fully taking advantage of the latest ICT solutions, were the causes of the above relationships.

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EKONOMICZNE UWARUNKOWANIA ZRÓŻNICOWANIA WYKLUCZENIA CYFROWEGO

STRESZCZENIE

W XXI wieku problem wykluczenia cyfrowego nabiera coraz większej dynamiki. Brak dostępu do technologii cyfrowej jest obecnie takim samym wykluczeniem jak niegdyś niewolnictwo, brak dostępu do edukacji lub pracy. W artykule przedstawiono wyniki badań dotyczących wpływu przynależności do grupy społeczno-ekonomicznej oraz dochodów na skalę i zróżnicowanie wykluczenia cyfrowego polskich gospodarstw domowych w latach 2003–2015. Do oceny wpływu wykorzystano autorski wskaźnik wykluczenia cyfrowego. Przeprowadzone badania wykazały, że w analizowanym okresie skala tego wykluczenia ulega stopniowemu zmniejszeniu, jednakże jego poziom był uzależniony od przynależności do danej grupy społeczno-ekonomicznej oraz wielkości dochodów. Ze wszystkich grup społeczno-ekonomicznych tylko wśród uczniów i studentów to zjawisko występowało w marginalnym stopniu. Z kolei wśród rolników, rencistów i emerytów było ono najbardziej zauważalne – blisko 80% osób z tych grup było wykluczonych lub zagrożonych wykluczeniem cyfrowym. W przypadku drugiego analizowanego czynnika badania wykazały, że wraz ze wzrostem dochodów skala wykluczenia cyfrowego oraz jego zróżnicowanie były coraz mniejsze.

Słowa kluczowe: ICT, dochody, grupa społeczno-ekonomiczna, zróżnicowanie, wielowymiarowa analiza danych