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Computerization of Polish Households in Social Structural Perspective: a Dynamic Analysis of the Informatization Process over 20 years

Abstract: This article, as a continuation of our previous paper *Stability and Change in Household Computer Possession in Poland: Analysis of Structural Determinants*, expresses the results from a set of analyses that had the following goals: 1) to describe the nature and process of informatization in Poland from 1988 to 2008; 2) to understand the factors that contribute to the digital divide in Poland; and 3) to contribute to the theoretical discourses on social dynamics and modernization. Studying the development of information and communication technologies (ICTs) in Poland is useful for both theoretical and methodological reasons. In 1988 the penetration of digital technology was low, however in 20 years since then, informatization has progressed to the point where it is on par with the rest of Western Europe and North America. This provides a good opportunity for examining the factors associated with the digital divide. Furthermore, as Poland developed intensely over a short period of time, it is likely to demonstrate a pattern similar to those countries which will go through the digital revolution in coming decades.

Keywords: informational society; personal computers; internet; digital divide; informatization; social change; occupational structure; social stratification; structural determinants.

Introduction

Several sociologists have recently been exploring the expansion of household personal computer possession in modern societies as it relates to various social structural factors. Much of this work has been driven by an interest in the so-called digital divide, while some authors have pursued a more specific interest in social change in post-socialist countries such as Poland (DiMaggio et al. 2001; Krzyszczuk & Green 2007; Ono and Zavodny 2008; Selhofer and Hüsing 2002; Selwyn 2004). This paper, looking at data from Poland, describes the results of an analysis which examines more closely the connection between information technology usage, particularly personal computer possession and internet use, and social outcomes such as income.

Conceptual Background

One of the most important facts affecting social life in the last century is the rapid development and expansion in use of new technologies such as plastics, television, electronic communications, and aeronautical aviation. Many commentators have argued that the computer technologies developed in the past forty years, which are rooted in digital technology that can easily collect and manipulate millions of bits of information, will have a uniquely significant and important long-term impact on the future of human societies (Bell 1981; Castells 1998, 2000, 2001; Doogan 2009). Given the impact of computer and information technology on our lives, it is important for sociologists and others to study how their use and application affects individuals and groups within society. This study seeks to do that by examining the predictors of household personal computer (PC) possession and internet use, as well as the effect of PC ownership and internet use on the location of individuals in the social structure.

Twenty years ago, few people around the world had personal computers in their homes, but during these last two decades more and more people have obtained PCs for personal and business use in the home. With the expansion of the World Wide Web in the 1990's, many people also have access to the internet in their homes. Indeed, for many professional and even working class families, access to the internet is considered indispensable. There are many potential benefits from having a personal computer and the internet, including small business development, social networking, and education. It is important to understand the process by which a society expands its 'connectivity' and how use of information and communication technologies (ICTs) such as PCs and the internet relates to the social structure.

As technology has rapidly expanded during the last generation, and the global economy has been transformed along with it, many commentators have speculated that there is a growing 'digital divide' in society. This division is made up of those, on one side, who have access to and use many of the latest technologies in their work and private lives, and those, on the other side, who have limited or no access to recent technologies. Those people, typically of lower social status, who lack access to current technologies could potentially lag so far behind their fellow citizens that they become almost like a group of "dinosaurs:" unable to compete in the dominant social and economic atmosphere, and therefore destined to suffer and remain on the bottom rungs of the social ladder. Ono and Zavodny (2008) found, for example, that non-English speaking residents of the USA, who are often impoverished recent immigrants, are less likely to have access to a PC or use the internet.

In contemporary analysis of patterns in Poland, Batorski (2007: 172) concluded that "the differences (among groups) in the use of new technologies ... are very substantial." Continuing, Batorski states that "this pertains, in particular, to the differences associated with education, age and social and professional status (172)." In conclusion, Batorski argues that:

the digital divide is a real problem, because the positive effects of using new technologies, which we are observing in the field of work, labor position and income, are available only for the selected population, which has greater chances and abilities of using computers and the Internet. It is worrying that, despite the

popularization of the new technologies, ... the importance of various social, demographic and economic factors for the use of new technologies is not diminishing. Moreover, persons from groups which have lesser opportunities of use more often than others use the new technologies for entertainment and less often for work or learning (179).

While many of the basic ICT working procedures (e.g. use of Windows, the web, email, etc.) can be easily taught to children or adults in an educational environment, the negative effects of a lag in ICT training and use can be significant for those who get behind to curve, so to speak. Because technologies rapidly evolve in the Twenty-first century, those members of society who do not possess a PC or cannot use the internet face the genuine possibility of being at a serious competitive disadvantage in a free market economy. In a study of the applications of technology in educational contexts in Poland, Polańska (2002) argues that it is necessary to enrich teaching methodology with virtual technologies in order to improve the learning process for the Twenty-first century student. To the extent that information and communication technologies are integrated into learning environments, we can expect that educated members of society will necessarily obtain higher ICT proficiency and by extension the benefits associated with such proficiency.

This study is driven by the following specific research questions: 1) which social and demographic factors influence the acquisition of a personal computer in the household and use of the internet,¹? and 2) is possession of a household PC and use of the internet related to an increase in personal income when controlling for various social and demographic factors. Also, since the data used in this study are from Poland, how have these connections changed over the time since Poland transitioned from a state-controlled to a free market economy and democratic post-industrial society?

Data, Measures, and Methods

Data. The results of our analysis are derived from data collected in the Polish Panel Survey (POLPAN), which is organized and supervised by a team of researchers at the Polish Academy of Sciences (see e.g. Slomczynski and Marquart-Pyatt 2007). This survey was administered every five years starting in 1988, so ultimately there are five waves of data: 1988, 1993, 1998, 2003, and 2008. The original panel consisted of 5817 Poles selected by random representative probability sampling procedures. In the second wave of the survey, 2259 subjects were re-interviewed. In the 1998 sample, 1752 of the original subjects were re-interviewed, and 383 new subjects were added. In the 2003 sample, 1474 subjects from previous waves were interviewed (1241 from the 1988 wave), and 225 new subjects were added. Finally, in the 2008 wave, 1224 previously interviewed subjects were included and 581 new subjects were included in the survey.¹ The analyses included in this report are based on subjects from different waves of POLPAN, so therefore each analysis contains a different number of subjects,

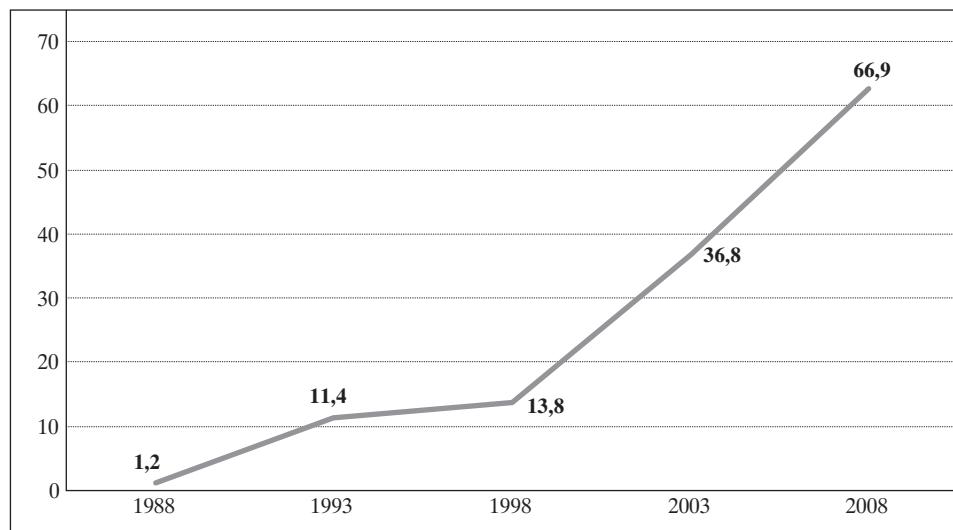
¹ The new subjects who were added were in the 21–25 age range. They were added in order to ensure the continued representativeness of the sample for future waves of the project. It is worth noting that after

depending on whether the analysis is based on information from one or more waves of data. The sample size for each analysis is included in the description of the results and in the tables which we present below.

PC Possession

In each of the five waves of the survey, subjects were asked whether at the time of the survey they possessed a PC in their household. Their responses, either 'yes' or 'no', were applied in our analyses of the correlates of household PC possession. The pattern of evolution in household PC possession is quite clear, and is displayed graphically in Figure 1. Consistent with common sense expectations, the number of Poles who possess a PC in their household has increased dramatically since 1988. Approximately, from a low of 1% in 1988, today 67% of Poles sampled now possess a PC. The biggest increase in PC possession occurred between 1998 and 2003, the time when the whole world saw a great increase in use of PCs, the internet, cell phones, and other forms of modern ICTs. The analyses presented in this study have the purpose of examining which factors are predictive of PC ownership in the recent waves of the panel, especially in the 2008 wave, as well as the extent to which PC possession is predictive of income in the different waves.

Figure 1
Changes in PC Possession in Polish Households
(Data Sources: POLPAN 1988–2008)



20 years of collecting data, the panel sample is not necessarily representative of the whole Polish population (21 and more) due to a lack of knowledge of who exited the pool and why. Perhaps the older and still living respondents are more educated and richer resulting in overrepresentation of PC owners in the sample.

Internet Use

In the 2003 wave, the survey included items pertaining to internet use. Respondents were asked if they had used the internet, either alone or with the help of others. This item was also included in the 2008 wave. In 2003 only 28.2% of respondents who gave a valid answer claimed to use the internet. By 2008, 57.6% of valid responses affirmed internet use. So in a five year period the number of internet users in Poland nearly doubled. In further analysis of internet use, we observed a high level of consistency among those using or not using the internet. Table 1 shows that among those who were personally using the internet in 2003, 91.8% continue to use it in 2008, while 73.0% of those who did not use the internet in 2003 also did not use it in 2008. This provides some evidence that among people generally, there are those who could be considered “net users” and others for whom the internet is not a part of their lives. As with PC possession, the analyses presented in this study examine which socio-economic factors are predictive of and affected by internet use.

Table 1
Stability in Internet Use between 2003 and 2008

<i>Did Respondent use the internet in:</i>	2008 Yes, personally	2008 Yes, with help	2008 No
2003—Yes, personally	91.8%	2.0%	6.3%
2003—Yes, with help	58.2%	16.5%	25.3%
2003—No	19.8%	7.2%	73.0%

Socio-Demographic Factors

Income was operationalized as the total amount of monthly earnings, in zlotys, from all sources. In the first wave of the sample, however, which occurred a year before the anti-communist revolution, most subjects had only one official job, so it was straightforward to include a question asking simply how much monthly income each respondent had from their main job. Over time, as the open economy and open employment markets grew, many respondents had more than one job or income from various sources, and therefore income was measured from all sources. For the 1993–2008 waves, income was calculated in the following way: every working respondent was asked about their main job (as defined by the total amount of time spent on that job), and other jobs performed. The sum of income from all jobs was added into one variable, “total income,” meaning the cumulative total of salaries or other earnings. In the Polish system it was typically one main job plus either a private business and/or additional part-time jobs.

Throughout our analyses, we include common sociological variables to determine their association with the dependent variables. In the original survey educational attainment was measured by asking respondents about their highest level of completed education. We recoded the answers in the following way: 4 = incomplete

elementary school; 8 = complete elementary school; 10 = incomplete secondary or basic vocational school; 12 = complete secondary or secondary vocational school; 14 = incomplete higher education; 17 = complete university education. The level of completed education has been a consistent correlate of PC possession and internet use during the 1988–2003 waves of POLPAN data. This study examines whether that is still the case.

Respondents were also coded according to their sex (0 = male, 1 = female), age, and their residency location (0 = rural, 1 = urban). While the results of our previous observations have found little difference in PC and internet use by sex, there has been a strong divide in PC and internet use by region of residence. Until 2003, urban residents were from two to three times as likely to possess a PC in comparison to rural residents. The results for 2008 shown in Table 2, however, show that now rural residents are only somewhat less likely to have a PC (59.1%) compared to urban residents (72.7%).

In the multi-variate analysis models focusing on predicting internet use and PC possession, the results of which are described below, we include both sex and region of residence as potential correlates in order to be certain of the nature of the association when controlling for other factors. Regarding age, previous analyses have shown an inconsistent but weak association between age and household PC possession; younger Poles have been slightly more likely to possess a PC. In the case of PC possession, which is measured at the household level, the link between age of the respondent and PC possession as measured may be underestimated. In this analysis we test whether this weak effect is still found in 2008.

Table 2

Percentage of Polish Households with a PC in Urban and Rural Areas: 1988 to 2008

<i>Region of Residency</i>	1988	1993	1998	2003	2008
Rural	0.5	5.0	4.7	23.4	59.1
Urban	1.8	14.9	18.7	45.8	72.7

Methods

Our first concern in the analysis is to build on our previous research, which focused on describing the socio-demographic factors that predict the likelihood of someone possessing a PC in their household or using the internet. We build on this by re-specifying some of our models and including data from the recently completed 2008 wave of POLPAN, which was not included in any of our previous analyses. In previous analysis and in the current analysis, we used logistic regression, with PC possession and internet use as dependent variables (in separate models). The results of the regressions indicate to what extent socio-economic and demographic factors influence the likelihood of possessing and using ICTs.

The second concern is to assess whether possessing a PC or using the internet has an effect on later income. This analysis has the purpose of providing evidence for the

notion that the digital divide truly impacts social status attainment. In order to test this idea, we ran an OLS regression model with income as the dependent variable and PC possession or internet use, along with other socio-demographic factors as the predictors. The results of these models tell us if possessing a PC or using the internet has a meaningful association with income when controlling for other factors.

Results

Predicting PC Possession and Internet Use

Previous research found that education and income were consistently associated with PC possession in Poland (Batorski 2007; Green & Kryszczuk 2006). Educational attainment typically had a stronger effect. In various models examining data from POLPAN 1988–2003, researchers have observed a weak inverse association between age and the likelihood of possessing a PC, but no meaningful association between sex and PC possession. Place of residence had a consistent significant association with PC possession; urban residents were much more likely to own a PC. The current analysis focuses on the 2008 data to determine if new patterns of PC possession have arisen in the last five years.

The logistic regression analysis results (see Table 3) show some patterns consistent with previous decades and some new patterns. Education and income remain correlated with PC possession, with education ($\text{Exp}(B) = 1.367$; $p < .001$) having a stronger effect than income ($\text{Exp}(B) = 1.000$; $p < .01$). This finding is consistent with previous research. Sex and age are not significantly associated with PC possession in 2008. While sex has not shown up as a meaningful predictor of PC possession in data from previous waves of POLPAN, age had been found to have a significant albeit weak association. The current results suggest that the age divide in PC ownership may be diminishing or disappearing as Polish society moves farther into the Twenty-first Century.² Finally, consistent with past research, urban households are more likely to possess a PC ($\text{Exp}(B) = 1.632$; $p < .01$).

Previous analyses of the correlates of internet use in the POLPAN data have been limited to 2003 only. In observations from the 2003 data Kryszczuk and Green (2007) found that place of residence, age, salary, and years of education were all associated with internet use. As with PC possession, sex was not a meaningful predictor of internet use. Table 4 shows the results of a logistical regression analysis of the multiple predictors of internet use in 2008. The results are consistent with previous findings. Urban residents are more than twice as likely to use the internet. Younger Poles are also more likely to use the internet than older Poles. Both income and years of education are still found to be positively associated with internet use in 2008. In

² This is a tentative explanation. In fact, our data are measured at the household level, so any statistical link, or a lack of one, between age of respondent and household PC possession could be erroneous. We are aware of the ecological fallacy potential in this analytical situation, however we suspect that with a large representative sample, a strong age effect on PC possession would show up in our procedures.

Table 3

Logistic Regression Results: Household PC Possession by Place of Residence, Sex, Age, Salary, and Education, 2008

Variables	B	Sig.	Exp(B)
Place of Residence, 1 = urban	.490	.007	1.632
Sex, 1 = female	-.051	.782	.950
Age	-.005	.438	.995
Salary	.000	.005	1.000
Years of Education	.313	.000	1.367
Constant	-2.692	.000	.068

Notes: n=952; Model chi-square = 135.811 (p < .05); Nagelkerke R² = .210

comparison to the model predicting household PC possession, the model predicting internet use is substantially more parsimonious. Nagelkerke's R² = .522 for the model on internet use, compared to .210 for the PC possession model. The effects of place of residence, age, income, and education are all stronger in the internet use model.

Table 4

Logistic Regression Results: Internet Use by Place of Residence, Sex, Age, Salary, and Education, 2008

Variables	B	Sig.	Exp(B)
Place of Residence, 1 = urban	1.164	.000	3.202
Sex, 1 = female	.148	.464	1.160
Age	-.057	.000	.944
Salary	.001	.000	1.001
Years of Education	.525	.000	1.690
Constant	-4.365	.000	.013

Notes: n = 953; Model chi-square = 432.333 (p < .05); Nagelkerke R² = .522

Income and PC Possession/Internet Use

One of our research questions asked whether PC possession and Internet use actually have a connection with income. In a regression analysis of the correlates of income (see Table 5), we found that, when controlling for sex, age, place of residence, and years of education, both previous PC possession and internet use (each measured in 2003) are positively associated with income in 2008. So while the standard socio-demographic variables of sex, age, education were all associated with income in the expected directions, we were surprised to find that PC owners earned about 533 zlotys (or \$190) more on average as compared to people without PCs, and internet owners earned 480 zlotys more on average as compared to non-internet users, when controlling for other factors. Although the overall strength of the standardized correlations for each factor was not strong ($\beta_{PC} = .14$ and $\beta_{Internet} = .13$), the overall model predicts nearly a fifth of the variation in current income ($R^2 = .19$).

Table 5

**OLS Regression Results: Income (100s of Polish Zlotys) by PC Possession, Internet Use,
Place of Residence, Sex, Age, and Education, 2008**

Variables	B	Sig.	Beta
PC Possession (2003)	5.331	.001	.142
Internet Use (personally or with help, 2003)	4.846	.007	.127
Place of Residence, 1 = urban	1.618	.291	.043
Sex, 1 = female	-6.037	.000	-.160
Age	.003	.593	.020
Years of Education	1.483	.000	.246
Constant	-1.998	.636	

Notes: n = 625; F = 24.519, p < .001; Adjusted R² = .184

Conclusions

The results of this study show us that some of the patterns related to PC and internet use and the digital divide have been consistent over time, while some patterns have changed. Poles from rural areas continue to be at a disadvantage as far as household PC possession and internet use. Urban Poles were more than twice as likely to use the internet in comparison to rural Poles in 2008. We suspect that this result stems from the lower number of internet service providers found in rural areas as compared to urban areas. This is an aspect of the digital divide found in most countries of the world. Another interesting observation from the 2008 data is that age seems to be no longer a meaningful predictor of PC possession, as it was in some previous years. Age remains, however, a significant predictor of internet use. Finally, in regards to our analysis of the connection between PC and internet use and income, we found the interesting result that PC possession and internet use are associated with higher income when controlling for basic socio-demographic factors. We regard the finding that ICT possession and use is positively associated with income as an important result in the sense that it gives us some evidence that the digital divide can have a socio-economic impact which is above and beyond the impact of other standard sociological predictors of income.

What do our results show us about the digital divide in Poland? First, they show that it persists. For example, in all of our analyses educational attainment and income are positively associated with PC possession and internet use. There had been some indication from previous analyses that income was becoming less of a meaningful predictor of PC possession, but these results contradict that. We had presumed that PCs in Poland were starting to reach a saturation point, such that so many households possess one, that income would no longer be a significant correlate with PC ownership. These results do not indicate that to be the case in 2008.

The second important conclusion based on our analysis is that the results from the analysis of income show that those who are using technology in the form of ICTs

can have a direct gain from that. PCs and the internet are not simply for fun and games or as a substitute for old fashioned mail. Rather, they are tools that certain people use to achieve real positive outcomes. In that light, to the extent that a divide remains in terms of PC ownership and internet use, we expect that an income divide will remain, thus giving evidence that the digital divide is an important component of social hierarchy calculus in the Twenty-first Century.

There are some limitations in the results presented in this study. The main one has to do with the variables for which we could control in our regression analyses. In some of the previous waves of POLPAN data, detailed information on the actual type of work the respondents were doing was available. Unfortunately that data is not yet available from the 2008 wave of POLPAN. In previous analyses we could examine the effects of income, education, and other variables on the digital divide while controlling for type of work. We expect this data to be available soon and will continue our analysis at that time.

Perhaps the main other limitation on making stronger conclusions based on the present results pertains to measurement. Since we have only the two measures, PC possession in the household and Internet use, we are not able to more deeply and fully explore the extent of use of these technologies. Having a more complete set of indicators that give a clearer image of whether and how these respondents are using PCs and the Internet would enable us to make better explicated conclusions about the causes and effects of the digital divide. We do in fact have a set of additional question items related to PC use in the 2008 sample, but we have not yet determined the best way to include those in our analyses. We anticipate that forthcoming work will incorporate that data as well as data about occupations.

In sum, we contend that access to, and facility with, ICTs are salient components of social structure in the Twenty-first Century, in Poland and elsewhere. The results of this study provide support for this conclusion in several ways. First, in the case of both PC possession and internet use, we continue to find disparity in PC possession and internet use based on educational attainment and income, and, in the case of internet use based on place of residence and age. Finally, evidence shows that those who possess PCs are likely to have a higher income compared to those without PCs, especially those who use the internet. A promising finding is that the urban/rural and age distinctions found in previous studies of PC possession have diminished to non-significance. We anticipate the completion of additional studies that will further clarify the connections between use of ICTS and social structure.

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