CHAPTER 12.

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COMPUTERIZATION OF POLISH HOUSEHOLDS: AN ANALYSIS OF STRUCTURAL DETERMINANTS OF THE DIGITAL DIVIDE

Since the beginning of the discipline, sociologists have been concerned with social dynamics: How and why does society change? There are many sociological traditions dealing with this rudimental question. From Comte's focus on "social dynamics" (Skarga 1966: 155), to Marx's emphasis on conflict as the root of social change (Marks [Marx] and Engels 1948), to Spencer's (1862) discussions of the "natural" evolution of societies, there has been a rich tradition of sociological theories that offer explanations on the movements of societies and cultures. Durkheim (2004) and Tönnies (2005) are also well known for their comparisons of traditional and modern societies. Both argued that post-industrial-revolution societies are notably unique in precise ways, primarily revolving around the forms of the division of labor and patterns of human interaction. Scholars in the twentieth century continued this discussion. From Parsons's (1968) description of pattern variables to the broad discussions surrounding modernization and world systems theories (Szacka 2003: 107), sociologists and economists have come to agree that a number of social and cultural characteristics distinguish current societies from those that existed centuries ago (Ashton 1948; Berger and Piore 1980).

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Modernization theory proposes one, primarily Western-oriented, pattern of social development. Theorists in this tradition perceive social development as a "universal and inevitable" process (Bell 1973; Drucker 1999). The general idea is simple: societies progress from agrarian orientation to industrial orientation, then finally to a postindustrial, service-oriented economic and social nature (Singelmann 1978). In this sense, modernization theory is a theory of *sequential* development.[1] The main macro-level indicator of such a transition is first the restructuring of the economy and society toward a decreasing primary sector (agriculture), then an increasing paid-employment sector (first, in industry—the secondary sector), and finally, at social maturity, a dominant tertiary sector (services). Economies at the most advanced stage of modernization are characterized by a predominance of employment in clerical and service-oriented fields, with professionals and managers at the top of the occupational hierarchy. Since global economies have been strictly linked to, and even depend on, the scientific and technological progress of the twentieth century, industrial societies and their structures change into postmodern forms (Bauman 2000).

The change in occupational structures combined with technological developments in information processing make a decent indicator for the next stage expected in the modernization process: the "information society." As many labor-intensive occupations have become reduced or automated, the intensity of "informatization" associated with work could soon become the main factor that divides workers into various social and economic hierarchies. Informatization includes increased reliance on computers, the Internet, mobile phones, fax machines, electronic bank transfers, television, satellite communications, and the digitalization of all sorts of information. The extent to which a given occupation requires the use and understanding of information and communication technology (ICT) and the skills necessary for adapting to new technologies is becoming a major factor in separating workers into various ranks of income and prestige. This shift is now referred to as the "digital divide" (Kling 1990).

This chapter describes the results from a set of analyses addressing the following goals: (1) to describe the nature and process of informatization in Poland from 1988 to 2003; (2) to understand the factors that contribute to the digital divide in Poland; and (3) to contribute to the theoretical discourse on social dynamics and modernization. Studying the development of ICTs in

[1] More generally, the notion of social *convergence* implies similarity in patterns of social structural changes across societies. Thus, one particular social order transforms into another sequentially.

Poland is useful for both theoretical and methodological reasons. Poland is a country that has experienced rapid development in the fifteen-plus years since its democratic revolution. In 1989 the penetration of digital technology was low; however, in the fifteen-plus 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 the one that will be experienced by countries going through the digital revolution in coming decades. Thus, the case of Poland is important for international comparative analyses.

Information Revolution and the Digital Divide

Despite Robert M. Solow's remark, that "one can see the computer age everywhere but in the productivity statistics" (Mullan 2000), the information revolution is perceived by many as critically necessary for the advancement of developing societies (Castells 2001; DiMaggio and Powell 1983). In the twenty-first century, developing countries that lack sophisticated information technology (IT) capacity and an IT-savvy workforce will have great difficulty developing their economies and merging with the increasingly integrated global marketplace. Thus, studying the diffusion of computers and the Internet is important for understanding current social change and social differentiation. One of the most important aspects of the development of the information society is the spread of digital information and communication technologies and tools such as the Internet and computers. Informatization in the contemporary context consists of: (a) widespread potential for and real access by individuals and social groups to information technologies and resources; (b) changes in communication networks (e.g., the emergence of new structures in information systems, new media, and the intensification of virtual communication); (c) change toward high technology with respect to preferences for socially desirable goods; and (d) a general rise in information resources, resulting in global and "total-reliability" economies and societies based on ICT.

Sociological analysis of the information revolution is crucial to the ongoing attempts of the discipline to explain the processes of social change and modernization of societies everywhere. There are many potential consequences of the development of ICT, some of which are likely to fundamentally change the basic patterns and norms related to the workplace, community, family,

politics, economics, and so forth. The following are five domains in which the information revolution, combined with associated patterns of globalization, could seriously change society: (1) inequality (e.g., the digital divide); (2) community and social capital (new tribes, Internet communities); (3) political participation (e-democracy, e-government); (4) organizations and other economic institutions (extra-nationalism, supra-nationalism, nongovernmental organizations such as the World Trade Organization, the European Union, and Greenpeace); and (5) cultural participation and diversity (the "global village," cultural synergy, terrorism, the "clash of civilizations").

Among these consequences of the information revolution, the digital divide—that is, inequality in access to ICT—is crucial for the study of social stratification. Those who have little or no access to ICT, or who lack the skills to use it, will be unable to participate in the new forms of community, politics, commerce, and culture. The digital divide can be assessed by examining: (1) *inequalities in access* to computers and the Internet; (2) the *extent of use* of ICT; (3) *understanding of computer search strategies*; (4) the *quality of technical connections and IT support*; (5) the *ability to evaluate the quality of information*; and (6) the *diversity of IT tools available*. In the present analysis, we focus on structural predictors of the digital divide in Poland, emphasizing inequalities in access to computers and the Internet, and the extent of their use.[2]

Research Goals

This chapter has two main goals: (1) to provide a cross-sectional description of personal computer (PC) owners and Internet users, and (2) to complete and interpret an analysis of socioeconomic determinants of changes in PC ownership and Internet use over fifteen years in Poland. Using panel data collected in four waves of panel research (1988, 1993, 1998, and 2003), we describe the "computerization" process in Polish households. Further, we consider whether structural factors such as education or income have influenced or supported changes in PC possession and Internet use in households.

[2] Another concern is the "global digital divide," that is inequalities in IT access across countries. This study is concerned with the "intra-national" digital divide and the structural predictors of it, and therefore we do not discuss international IT inequalities here. For more information on the global digital divide, see Guillen and Suarez (2005) and Crenshaw and Robison (2006).

Household PC possession increases the probability of use of the PC and the Internet, and, despite not having more precise information about the digital divide, through observation and analysis of the history of the computerization process from the beginning of the Polish transformation in 1989, we can assess the extent to which some social structural factors are perhaps related to informatization, and, by implication, other social outcomes.

Several specific hypotheses motivate this research. We expect that educational attainment and income are positively associated with both PC possession and Internet use throughout recent Polish history. We also expect that various other social and demographic factors influence PC possession and Internet use. More specifically, the gender and age of respondents may be associated with PC possession and Internet use; we expect that if there is an association here, men and younger respondents are more likely to be "wired" into ICT. Additionally, we expect that urban respondents and respondents with children in their households may be more likely to possess PCs and use the Internet. Finally, we expect that respondents from professional, technical, and clerical occupations are more likely to possess PCs and use the Internet than are respondents in craft trades, elementary occupations, and agricultural trades.

Analysis and Results

The data for this analysis come from a panel study conducted in four waves (1988, 1993, 1998, and 2003) on nationwide probability samples by the Research Team on Comparative Social Inequality at the Institute of Philosophy and Sociology of the Polish Academy of Sciences. This study was coordinated by Kazimierz M. Slomczynski (see Slomczynski et al. 1989; Slomczynski 2000, 2002). The panel study is referred to throughout by the abbreviation POLPAN. All results presented in this chapter are derived from the POLPAN data. The initial wave of the survey included 5,817 participants in 1988. Of those original respondents, 2,259 were reinterviewed in 1993. In the last two waves (1998 and 2003), to improve representation, samples were extended to include respondents twenty-one to twenty-five years old. The 1998 sample size was 2,135, of whom 383 were new respondents; in 2003 the sample size was 1,699, with 225 new respondents.[3]

[3] Thus, the sample size for particular analyses is different depending on which waves are being included.

In addition to a number of standard demographic indicators, our analysis focuses on the associations between household PC possession, Internet use, educational attainment, and income. Our broad emphasis is on the digital divide, which has many aspects; however, since our data were limited in terms of measurement of these various aspects, we focus on two aspects: household possession of a personal computer and use of the Internet. Each respondent was asked whether or not their household possessed a PC in the previous year. PC possession in the household increases the respondent's probability of using the PC as well as the Internet. We categorized all respondents who declare use of the Internet personally and with the help of others in the group "Internet users."[4] The Internet-use item was measured only in the last wave, so we limit that analysis to the year 2003. In our models, education and income are expressed as years of schooling and monthly personal income. Education was coded in the following way: incomplete elementary = 4 years; elementary = 8; basic vocational and incomplete secondary = 10; secondary vocational and general secondary = 12; postsecondary vocational and incomplete higher = 14; university = 17. Income is measured in Polish zlotys and includes total salary from all jobs in 1993, 1998, and 2003. For 1988, income includes only money earned from the main job.

Changes in PC Possession During 1988–2003

During 1988–2003, the percentage of new households that possessed a PC increased about 2.4 percent per year on average. In 1988 only 1.3 percent of households in Poland possessed a PC; after ten years this rate grew to 36.8 percent. The most remarkable increase—almost three times—between 1998 and 2003, was due to the rapid popularization of the Internet at the end of the millennium. Table 12.1 shows the distribution of respondents in terms of household PC ownership across all four panel years. Among those respondents represented in all four waves of the study, 65.4 percent never possessed a PC in their household. Only 0.2 percent declared household PC ownership in all four waves.

[4] A total of 103 respondents declared use of the Internet with "help of the others," which is 6.1 percent of all those who answered this question.

Table 12.1. Declaration of Household Personal Computer (PC) Possession During Panel Study

	%	*N*
Never declared PC possession	65.4	274
One declaration	19.3	81
Two declarations	10.5	44
Three declarations	4.5	19
Possessed PC during whole panel	0.2	1
Total	100.0	419

Note: Includes only respondents interviewed during whole panel, not including subsamples of the young from the 1998 and 2003 waves.

We also examined changes and stability in household PC possession by respondents across panel waves, which revealed several interesting patterns and trends. Of those who had a PC in 1988, 63.6 percent declared not having a PC in 1993. Of those who did not have a PC in 1988, only 10.6 percent had one five years later. Of those who did have a PC in 1993, only 4.9 percent had one previously, meaning that 95.1 percent of PC owners were "new" owners at that time. These results indicate that before the mid-1990s, PC possession was rather randomly distributed across Polish households. Computers were perhaps thought of more as an amusing toy for children than as a useful, almost crucial, device for everyday life. Based on later data, we observed that the process of computerization reached a turning point around 1998, when it became much more common to possess a PC. By 1998, 68.1 percent of all PC owners had one previously, so, by then, new PC owners accounted for only 31.9 percent. In 2003, only 23.7 percent of PC owners were new owners. Table 12.2 shows data on the patterns of change and stability in PC possession across waves of the panel.

Table 12.2. Changes and Stability in Personal Computer (PC) Possession for Each Wave

	Households that owned a PC		
	1993	1998	2003
Households that had a PC in 1988 (%)	36.4	66.7	100.0
Households that had a PC in 1993 (%)		45.5	75.0
Households that had a PC in 1998 (%)			82.5
Total households that owned a PC in particular wave (number)	257	295	621

Sociodemographic Patterns in Household Personal Computer Ownership

From 1988 to 2003, place of residence was an important factor for inequalities in PC possession in Polish households. Table 12.3 shows the results of a comparison of the relative number of households that possessed a PC in rural and urban areas. In the first three waves of the study, urban households were approximately three times more likely to own a PC than were rural households. By 2003, this disparity had slightly declined. From 1998 to 2003, the pace of computerization in rural areas was 2.5 times faster than in urban areas. Thus, urban households were only twice as likely to possess a PC in 2003: 45.8 percent of urban households possessed a PC, while 23.4 percent of rural households possessed one. Although there is still a visible informatization gap between urban and rural households, computers became a very important tool for everyday life issues, work, and children's educational requirements, even in rural areas. In the most recent decade, many political and social programs supported the purchase of PCs for schools in the countryside; this may have triggered the trend for rural households to buy PCs.

Table 12.3. Households That Possess Personal Computers by Place of Residence (%)

	1988	1993	1998	2003
Rural	0.5	5.0	4.7	23.4
Urban	1.8	14.9	18.7	45.8

Household PC ownership is also closely connected to employment status. Table 12.4 shows a comparison of working and nonworking respondents in terms of PC possession. Working respondents are more likely than nonworking respondents to possess a PC in all of the waves. In waves 1993 through 2003, working respondents were more than twice as likely to own a PC. In the final wave, in 2003, 50.4 percent of working respondents possessed a PC in their household as compared with only 22.9 percent of nonworking respondents.

Table 12.4. Households That Possess Personal Computers by Employment Status (%)

	1988	1993	1998	2003
Not working at present	1.1	3.9	7.5	22.9
Working	1.3	12.8	18.6	50.4

Looking more closely at employment, we see clear differences in terms of PC possession and use when comparing respondents from different occupational strata. Tables 12.5 and 12.6 show patterns of PC ownership and use among respondents from different occupational strata. Table 12.5 shows the percentage of respondents in each of several occupational categories who possessed a PC in their household, as well as the average rate of growth in household PC possession across the four waves of the study. Managers, professionals, technicians, clerical and service workers are consistently more likely to possess a PC in their household, as compared with agricultural workers, craft and trade workers, and elementary occupations. In more recent waves, managers and professionals are most likely to possess a PC (73.4 percent in 2003), while farmers and agricultural workers are consistently the least likely to possess one. But, after 1998 there was a huge rise in PC possession, even among farmers—up from 1.7 percent to 25.8 percent in 2003—and elementary occupations—up from 5 percent to 40.9 percent in 2003!

Table 12.5. Distribution of Household Personal Computer Possession by Occupational Strata Across Four Waves of the Panel (%)

Occupational strata in 2003	1988	1993	1998	2003	Average growth per year
Managers and professionals	4.7	30.6	40.8	73.4	4.58
Technicians	7.4	28.6	32.0	71.1	4.24
Clerks and services workers	3.7	26.8	21.9	50.9	3.14
Farmers and skilled agricultural workers	0	3.2	1.7	25.8	2.26
Craft and trade workers	0	17.2	10.8	35.0	1.78
Operator and elementary occupations	0	11.8	5.0	40.9	2.91

PC possession does not necessarily imply actual PC use. Although many people may have a PC, the actual use of a PC is closely tied to occupational position. Table 12.6 compares respondents from different occupational categories in terms of PC possession and use in 2003 along the lines of the following four possibilities: (1) respondent *neither had nor used* a PC, (2) respondent *had but did not use* a PC, (3) respondent *used a PC but did not have* one, and (4) respondent *both had and used* a PC. The results show that managers and professionals (6.9 percent) and technicians (13.2 percent) were least likely to report neither having nor using a PC. Similarly those groups were most likely to report both having and using a PC (managers and professionals 69.4 percent; technicians 61.4 percent). A large number of operators/elementary workers (18.2 percent) reported having but not using

a PC. According to these results, it seems clear that informational workers (or white-collar workers) are more accustomed to working with PCs, whether they own one or not. In comparison, we see relatively large percentages of agricultural workers (16.7 percent), craft and trade workers (11.9 percent), and elementary operators (18.2 percent) whose contact with PCs is rather "inactive"; they possessed but did not use a PC. Clerical workers are on the opposite end of the spectrum: they are the most likely to report using (probably at their office), but not owning a PC (20.5 percent).

Table 12.6. Personal Computer (PC) Access and Use in 2003 by Occupational Strata (values represent percentages within each occupational category)

Occupational strata in 2003	Did not have/did not use PC	Had but did not use PC	Used but did not have PC	Had and used PC
Managers and professionals	6.9	4.0	19.7	69.4
Technicians	13.2	9.6	15.8	61.4
Clerks and services workers	28.7	12.3	20.5	38.6
Farmers/skilled agricultural workers	69.2	16.7	5.0	9.2
Craft and trade workers	53.8	11.9	11.2	23.1
Operator and elementary occupations	52.3	18.2	6.8	22.7
Total	305	100	118	330

Connections Between Education and Income and Household Personal Computer Possession

Logistic regression analysis was applied to test the association between years of schooling and income and PC possession across the five-year time intervals of the panels. Tables 12.7, 12.8, and 12.9 display the results of these analyses. The results presented in Table 12.7 show three models, in each of which PC possession was regressed on years of schooling, monthly income, sex, and age, as well as a control variable indicating PC possession in the previous wave. For example, Model 1 includes the predictor of PC possession in 1993 while controlling for PC possession in 1988. Years of schooling and income are also measured from the previous wave. This analysis provides some interesting results. In each of the models, years of schooling is a significant predictor of PC possession ($p < 0.01$), even when controlling for income: those with more education are more likely to possess a PC. Age is also a significant and negative predictor in all three models: younger respondents are more likely to possess

a PC.[5] PC possession in 1998 and 2003 is strongly correlated with possession of a PC in the previous wave, which indicates the trend toward stabilization of PC possession. Surprisingly, monthly job income measured during the previous wave of the panel is not significantly associated with current PC possession in any of the models, when controlling for the other factors. Gender is not significantly associated with PC possession in any of the models.

Table 12.7. Logistic Regression Results: Personal Computer (PC) Possession in 1993–2003 Regressed on Education, Income, Previous PC Possession, Sex, and Age

Variables	B	Significance	Exp(B)
Model 1. PC possession in 1993 by education, income, PC possession, sex, and age in 1988			
Years of schooling 1988	0.249	0.000	1.282
Income 1988	0.000	0.959	1.000
PC possession 1988	0.318	0.673	1.375
Sex (male = 0; female = 1)	0.334	0.233	1.397
Age	–0.056	0.001	0.945
Model χ^2 50.33 (*df* 5) (0.0000)			
Model 2. PC possession in 1998 by education, income, PC possession, sex, and age in 1993			
Years of schooling 1993	0.276	0.000	1.318
Income 1993	0.000	0.890	1.000
PC possession 1993	1.463	0.000	4.913
Sex (male = 0; female = 1)	–0.145	0.437	0.865
Age	–0.042	0.000	0.959
Model χ^2 192.21 (*df* 5) (0.0000)			
Model 3. PC possession in 2003 by education, income, PC possession, sex, and age in 1998			
Years of schooling 1998	0.186	0.000	1.204
Income 1998	0.000	0.296	1.000
PC possession 1998	2.203	0.000	9.053
Sex (male = 0; female = 1)	–0.016	0.925	0.984
Age	–0.025	0.001	0.975
Model χ^2 177.02 (*df* 5) (0.0000)			

[5] This is an interesting finding because, even if we are using a very basic indicator (PC possession at the household level, which does not take into account the person who is in fact using the PC), we still consistently find a negative association between age and digital divide. This finding holds across all waves, including later waves when PC possession became more common.

Table 12.8. Logistic Regression Results: Personal Computer (PC) Possession in 1993–2003 Regressed on Concurrently Measured Education and Income, Previous PC Possession, Sex, and Age

Variables	B	Significance	Exp(B)
Model 4. PC possession by education, income, sex, and age in 1993—controlled by PC possession in 1988			
Years of schooling 1993 (standardized score)	0.671	0.000	1.957
Income 1993 (standardized score)	0.021	0.790	1.021
PC possession in 1988	0.489	0.463	1.630
Sex (male = 0; female = 1)	0.342	0.217	1.408
Age	–0.032	0.054	0.968
Model χ^2 33.60 (*df* 5) (0.0000)			
Model 5. PC possession by education, income, sex, and age in 1998—controlled by PC possession in 1993			
Years of schooling 1998 (standardized score)	0.730	0.000	2.076
Income 1998 (standardized score)	0.217	0.015	1.243
PC possession in 1993	1.523	0.000	4.587
Sex (male = 0; female = 1)	–0.035	0.859	0.966
Age	–0.020	0.114	0.980
Model χ^2 155.01 (*df* 5) (0.0000)			
Model 6. PC possession by education, income, sex, and age in 2003—controlled by PC possession in 1998			
Years of schooling 2003 (standardized score)	0.565	0.000	1.759
Income 2003 (standardized score)	0.665	0.000	1.945
PC possession in 1998	2.138	0.000	8.482
Sex (male = 0; female = 1)	–0.064	0.718	0.938
Age	–0.016	0.054	0.984
Model χ^2 193.19 (*df* 5) (0.0000)			

Considering that the effects of education and income on PC possession may be more proximal, we also ran a series of regressions in which current PC possession is regressed on current educational attainment and current income, along with other control variables. Table 12.8 shows the results of these analyses. These models were analyzed to discover the concurrent relationships among these variables and to compare the relative strength of correlation between the predictors and the dependent variable.

We used standardized scores to compare the predictive power of education and income across and within each wave. Again, there are three models, each one regressing PC possession in 1993, 1998, and 2003 on the predictor variables. When income is measured concurrently, it is significantly

associated with PC possession ($p < 0.01$) in the 1998 and 2003 waves. Years of schooling remains a significant predictor of PC possession in all three waves. Age no longer has a statistically significant coefficient when education and income are measured concurrently with PC possession. Gender remains uncorrelated with PC possession, a surprising finding given that males are thought to be more computer/tech oriented than women. According to our findings in this analysis, only education was predictive of PC possession in 1993. By 1998 education and previous PC possession were the strongest predictors, but income also became a meaningful predictor. In 2003, income was a stronger correlate of current PC possession than educational attainment.

Table 12.9. Logistic Regression of Personal Computer Possession by Education, Income, Sex, Age, Place of Residence, and Occupational Group in 2003

Variables	B	Significance	Exp(B)
Years of schooling 2003 (standardized score)	0.422	0.035	1.525
Income 2003 (standardized score)	0.657	0.000	1.929
Sex (male = 0; female = 1)	–0.106	0.529	0.899
Age	–0.021	0.002	0.979
Place of residence (rural = 0; urban = 1)	0.537	0.005	1.712
Occupational group (farmers = ref.):		0.004	
Managers and professionals	0.390	0.102	1.476
Technicians	0.713	0.000	2.040
Clerks and services workers	–0.020	0.901	0.980
Crafts	–0.512	0.007	0.599
Operators and elementary occupations	–0.166	0.371	0.847
Model χ^2 178.866 (*df* 10) (0.0000)			

An analysis including place of residence and occupational group categories in the model, using data from 2003, is presented in Table 12.9. Occupational groups are included in the model as a series of dummy variables, with farmers as the reference category. The results show that current income remains a significant predictor of current PC possession, even when controlling for occupational categories. Age and place of residence are significant predictors as well, with younger and urban respondents more likely to possess a PC. Years of schooling is not a significant predictor at the 0.01 alpha level, however the exponent (B) value indicates that it is likely associated with current PC possession, and it is statistically significant at the alpha

0.05 level. Within the occupational groups, technicians are significantly more likely to possess a PC than are farm workers. Craft workers are less likely to possess a PC than farmers. Managers/professionals, clerks/service workers, and operators are not significantly more likely than farmers to possess a PC, when controlling for the other variables in the model. The overall results from this model appear to show a bit of leveling out in terms of PC ownership. Because possessing a PC is more common throughout all segments of society in recent years, we see decreased importance of education and type of job. The most important predictors of current PC possession in 2003 are: income, age, place of residence, technician worker status (on the positive side compared with farmers) and craft worker status (on the negative side compared with farmers).

Table 12.10. Households That Possess a Personal Computer by Presence of Child (age fourteen or under; %)

	Households that possess PC in:			
	1988	1993	1998	2003
Households without children	1.0	5.6	13.4	34.5
Households with children	1.4	17.2	14.5	41.6
Fisher's exact test (one-sided significance)	0.260 (ns.)	0.000	0.271 (ns.)	0.003

Household Personal Computer Possession and the Presence of Children

Another important factor affecting household PC possession is the presence of children in the household. Many parents may have purchased a PC as part of their child's education or for other school-related work. Table 12.10 shows the percentage of households that possess a PC depending on whether or not at least one child aged fourteen or under is present. The results show that in two of the waves (1993, 2003) households with children are significantly more likely to possess a PC. In all of the models there was a greater percentage of households possessing a PC among those that had at least one child present.

The results of logistic regression analysis presented in Table 12.11 show that, when controlling for other predictors, households in which a child was present were significantly more likely to possess a PC only in the 1993 wave.

In 1998 and 2003 the effect was negligible. We conclude from these results that the presence of a child was an important predictor in the initial phase of computerization, but when computer ownership became more common, this is less meaningful, especially when controlling for other correlates.

Table 12.11. Logistical Regression Results: Personal Computer Possession in 1993–2003 Regressed on Concurrently Measured Education and Income, Sex, Age, Place of Residence, and Presence of a Child

Variables	B	Significance	Exp(B)
Model 7: PC Possession by previous predictors, plus presence of a child—1993			
Years of schooling	0.190	0.000	1.209
Income	0.000	0.259	1.000
Sex (male = 0; female = 1)	–0.106	0.520	0.900
Age	–0.013	0.239	0.987
Place of residence (rural = 0; urban = 1)	1.004	0.000	2.730
Child presence (1 = yes)	1.084	0.000	2.955
(n = 1,376) model χ^2 140.851 (*df* 6) (0.000); Nagelkerke R^2 0.174			
Model 8: PC Possession by previous predictors, plus presence of a child—1998			
Years of schooling	0.236	0.000	1.266
Income	0.000	0.004	1.000
Sex (male = 0; female = 1)	–0.148	0.402	0.862
Age	–0.013	0.148	0.987
Place of residence (rural = 0; urban = 1)	1.255	0.000	3.507
Child presence (1 = yes)	–0.127	0.498	0.881
(n = 1095) model χ^2 156.404 (*df* 6) (0.000); Nagelkerke R^2 0.218			
Model 9: PC Possession by previous predictors, plus presence of a child—2003			
Years of schooling	0.167	0.000	1.182
Income	0.000	0.000	1.001
Sex (male = 0; female = 1)	0.012	0.942	1.012
Age	–0.017	0.011	0.983
Place of residence (rural = 0; urban = 1)	0.684	0.000	1.982
Child presence (1 = yes)	0.237	0.151	1.268
(n = 830) model χ^2 163.045 (*df* 6) (0.000); Nagelkerke R^2 0.238			

Internet Use

In our final analysis, we test the association between our predictor variables and use of the Internet, measured simply as use or nonuse of the Internet in 2003.[6] In a logistic regression we examined the connections between education, income, sex, age, place of residence, presence of a child, and occupational group and Internet use. The results, shown in Table 12.12, reveal that those with more education are more likely to use the Internet; those with more income are more likely to use the Internet; younger respondents are more likely to use the Internet; and urban residents are more likely to use the Internet. There is no significant difference in Internet use between males and females nor does having a child in one's household affect Internet use. In comparing occupational groups, we observe that in comparison with agricultural workers, managers, professionals, and technicians are more likely to use the Internet while craft workers and elementary occupations are less likely to use the Internet. Clearly, various structural and demographic factors are related to Internet use, another dimension of the digital divide.

Table 12.12. Logistic Regression of Internet Use by Education, Income, Sex, Age, Place of Residence, Presence of a Child, and Occupational Group in 2003

Variables	B	Significance	Exp(B)
Years of schooling 2003 (standardized score)	0.804	0.001	2.234
Income 2003 (standardized score)	0.730	0.000	2.075
Sex (male = 0; female = 1)	–0.342	0.096	0.710
Age	–0.076	0.000	0.927
Place of residence (rural = 0; urban = 1)	0.695	0.003	2.003
Child presence (1 = yes)	–0.225	0.265	0.799
Occupational group (farmers = ref.):		0.000	
Managers and professionals	1.519	0.000	4.568
Technicians	1.042	0.000	2.835
Clerks and services workers	0.113	0.556	1.120
Crafts	–0.863	0.000	0.422
Operators and elementary occupations	–0.957	0.000	0.384
(n = 831) model χ^2 413.049 (df 11) (0.0000) Nagelkerke R^2 0.528			

[6] All respondents who declared use of the Internet are coded into one YES-category—no matter how often they used it.

Computerization of Poland in Comparative Context

How does the Polish case compare with other countries in Europe? We have described in detail the computerization process in Poland from 1988 to 2003, but is the Polish case typical? And how does it relate to other similar countries? While these questions should be explored further in another study, for comparative purposes, we present some data on IT spending and Internet use across other European Union countries and countries at similar levels of development.

Table 12.13 shows the spending in each of several European countries on IT hardware and software. The data are presented to show the relative amount of increase in IT spending compared with the 1993 baseline amount of 100 percent. The pattern of increase shows that Poland did have a dramatic increase—almost two and a half times—in overall IT spending from 1993 to 1999. While Hungary also showed an increase of 66 percent in spending over the same time period, Russia showed very little growth in IT spending over that period. This shows that Poland was unique relative to other former state-socialist countries. Furthermore, Poland also outpaced other Western countries, such as France, Germany, and Great Britain, over the same period.

Table 12.13. Information Technology (IT) Spending Dynamics of Assorted European Countries During 1993–2001 (1993 baseline amount is 100 percent; the following values reflect the relative rate of IT spending for the respective years)

	1993	1994	1999	2000	2001
Poland	100	116	242	116	111
Hungary	100	115	166	113	111
Russia	100	150	102	105	115
France	100	103	171	111	109
Germany	100	105	136	110	110
Great Britain	100	107	216	111	110

Source: Data taken from Kisielnicki (2002: 104).

While Table 12.13 depicts patterns in IT spending, Table 12.14 shows the actual levels of Internet access and use among fourteen European countries plus Israel. Although Poland leads in relative IT spending among several countries during the 1990s, it is still at the low end of the spectrum for Internet access and use. Among the countries for which data are presented, the Scandinavian countries and the Netherlands lead in Internet access, with

roughly three-quarters of the population having access. Poland falls into the lower third of this group, closer to Hungary, Spain, and Portugal in terms of Internet access and use, with approximately 38 percent of the population having Internet access. The data shown in Tables 12.13 and 12.14 show that despite high levels of recent spending on IT, Poland still lags behind more developed countries in terms of access to IT. Still, Poland is not far from other countries, such as Greece, Spain, and Portugal, that were not part of the former state-socialist republics of the Eastern bloc.

Table 12.14. Access and Use of the Internet in Various European Countries Plus Israel, 2002 (%)

	Share of those with access to the Internet	Internet users
Sweden	78.0	66.9
Denmark	76.5	62.2
Finland	76.0	56.1
Norway	75.3	62.1
Netherlands	73.1	55.9
Belgium	67.1	43.7
Ireland	66.2	40.4
Great Britain	57.6	45.2
Israel	54.3	39.1
Italy	53.2	30.4
Hungary	46.2	19.5
Poland	38.7	23.8
Portugal	37.8	29.7
Spain	35.4	22.1
Greece	25.8	13.2

Source: Data are from the European Social Survey (2004; round 1) on a random representative sample of adults.

Conclusions

Summary of Results

Diffusion of the PC and Internet use in Poland have been significantly determined by basic structural factors. From the beginning of the computerization process in Poland, previous education and age have been related to the probability of possessing a PC in the household. Analysis shows that previous

income did not influence future chances of having a PC five years later. But if we analyze the situation in a particular year (1993, 1998, or 2003), respondent's current economic situation is a significant factor for PC possession, especially in the last year investigated, 2003. In the last wave of the study, we observe a tendency of decreasing influence for education and age factors. Nevertheless, we conclude that education, age, income, place of residence, and socio-occupational position (particularly manual versus nonmanual) apparently still diversify the possibility of having a PC in the household. Considering the relatively short period and rapid pace of the computerization process, we can expect that personal computers will soon become a common commodity in Polish households, even in rural areas. The results shown in Table 12.6, which depicts the trends in growth of PC ownership, confirm the rapid growth in PC access among low-skilled and agricultural workers, particularly between 1998 and 2003. Regarding Internet use, we found that educational attainment, income, age, place of residence, and occupational category are significantly associated with Internet use.

Implications for Social Stratification and Suggestions Regarding the Digital Divide Approach

One may distinguish two different perspectives when focusing on the social consequences of the digital divide. From the information-society perspective on social stratification, the digital divide is perceived as distinctive and crucial in relation to other dimensions of socioeconomic dissimilarities. This perspective presumes that the digital divide splits social groups into bipolar categories—informational winners or losers—due to the privileged position of informational innovators, whose better position is based on competitiveness, flexibility, and ICT amenability in the new institutional context. For example, Internet users have extensive and easier access to some important and socially desired informational commodities and cultural goods. Therefore, digital technologies may reorganize and stimulate changes in the social action system, which will lead to institutional transformation.

A consistent pattern emerges when comparing correlates of PC possession and Internet use. Tables 12.9 and 12.12 show results from similar logistic regression analyses with PC possession and Internet use, respectively, as the criterion variables. The tables show that income, age, urban residence, and two of the occupational categories (technicians and craft workers, as compared with farmers) were significantly associated with both outcome measures. There were, however, a couple of notable differences in the results with regard to education, which does influence Internet use, and

two additional occupational categories (managers/professionals and operators/elementary occupations, compared with farmers), which affect Internet use but not PC possession in the most recent wave of the study. These findings show that the digital divide may increase the gap between members of higher and lower strata of the socioeconomic status spectrum.

From a structural perspective, the digital divide is derived from fundamental factors of socioeconomic status. One can investigate inequalities in access to ICT in relation to people's occupational role, class, or strata positions and particular aspects of social stratification. New technologies can potentially play two different roles in the socioeconomic system of inequalities: they can either preserve existing dissimilarities between people and social groups or transform them into a new system of social hierarchy. In such a new system, digital information technologies could be a strong positive factor for the democratization and *leveling* of social opportunities to achieve socially desirable goods. Thus, investigation of the structural basis for the digital divide is crucial to the description and understanding of today's social and economic inequalities. Access and efficiency in the procedures of ICT have become basic conditions for standard participation and a successful life in the information society (Castells 2001).

Our analysis of PC ownership/Internet use and social structural factors focused on educational attainment and income. Education and income represent two different cultural and material dimensions that constitute a core of the social stratification system. In looking at the association between education and PC possession/Internet use, we assessed the proposition that educational attainment and the acquisition of ICT skills are driving the digital divide. If educational attainment is linked closely with PC possession and Internet use, we can conclude, based on the notion that ICT skills are necessary for success in the information age, that future social hierarchies will be *transformed* into new ranks defined, at least in part, by the mastery of information technology. Consequently, the synergy of knowledge and technological competence (the ability for rational, constructive, and effective IT use) could become the main structural criterion of the division of labor, and thus of social structure.

Regarding the association between income and PC possession/Internet use, we assessed the idea that acquisition of ICT skills is a mechanism for *preserving* the current social hierarchy. If it is primarily people who are already well off financially who gain access to PCs, then it is likely that PC ownership will simply be another tool through which the current upper occupational strata maintain their social positions. This is not to say that wealth is only a predictor of technological competence, but rather that wealth will be

a result of it. Still, in the early stages of technological innovations, wealth likely raises the possibility of possessing expensive IT tools. The connection between wealth and IT skills may be a reciprocal effect.[7] Because we are analyzing the very beginning of the informatization process, we are only able to generally assess the intercorrelations between financial position, education, and PC ownership/Internet use.

The results of our study provide a mixed answer to the question of whether computerization will transform or preserve the social hierarchy structure. When current PC possession is regressed on income five years ago, there is no statistically significant association, controlling for other factors. Educational attainment is, however, consistently associated with PC possession in those models. Considering that social strata position tends to remain relatively stable over time, these results lead us to conclude that the acquisition of information and communication technologies is more closely linked with education than with one's financial position in social structure. This conclusion provides evidence that the IT revolution could transform social stratification structures—particularly in economic dimensions.

When current PC possession is regressed on current income, however, the results are somewhat different. Along with education, current income has a significant association with PC possession. This finding leads us to rethink our conclusion regarding educational attainment and speculate that the revolution in informational and communication technologies will not do much more than preserve existing social hierarchy structures. The final analysis further supports this conclusion, as years of schooling became less strongly associated with PC possession, and there were significant differences between workers in advanced occupational categories and workers in basic occupations. The results shown in Table 12.6, for example, reveal that, when it comes to both having and using a PC, there are still very large differences between managers (69.4 percent) and technicians (61.4 percent) as compared with farmers (9.2 percent), craft workers (23.1 percent), and elementary operators (22.7 percent).

Perhaps there was a brief historical window in which individuals from the middle and lower classes could dramatically raise their social rank through IT skills acquisition. This window may now be closing as the wealthy begin to understand the importance of new technologies and they use their wealth and access to ensure that they do not get left behind in the digital revolution. As information technologies become ubiquitous, PC and Internet access

[7] We did not statistically assess any possible reciprocal relationship between wealth and IT use in this chapter. It is a relationship that we intend to study in future work. See the section "Extensions and Proposals for Future Work" below.

among the lower classes may not be likely to contribute much to individual or family change in the social hierarchies.

In the context of the welfare-state debate and inequality-reduction policies, it is necessary to pay more attention to the consequences of the digital divide. ICT is a very important tool for active participation in the labor market, culture, and democracy—even on a global scale. There is a clear need for members of the lower strata to acquire access to IT resources if they are going to be likely to get ahead. In an informal interview with a social services provider in the United States, we discovered the seriousness of this need. The social services coordinator with whom we spoke works primarily with poor African-Americans living in public-assistance housing. She mentioned that in her attempts (in 2005) to help her clients find work she discovered that nearly all of them did not have a personal computer, most had never used e-mail, many did not know how to operate a PC, and few of them had any idea how to submit a résumé, for example, electronically (Conneally 2005). As the digitalization of society proceeds, people without these skills will be left even further behind.

Implications for Social Dynamics, Modernization, Politics, and Economics

In this chapter we described and analyzed the process we refer to as "computerization" or "informatization" of Polish society. In 1988, at the beginning of our sample time frame, Poland was only in the initial stages of adoption of high-tech, digital computer, and information technology. Over the fifteen years spanned by our samples, Polish people exhibited a sharp increase in PC ownership and Internet use. Still, there is a clear borderline between young and old and urban and rural people in access and use of the Internet.

Our analyses demonstrated clear connections between computerization and structural factors such as education, income, and occupation. Based on these findings we speculate that such structural factors are likely to contribute to a digital divide throughout all societies progressing through digitalization. While it is likely that someday, the whole world will be "wired," the process begins when educated, wealthy, urban professionals obtain PCs and IT skills. The ability of this social group to get ahead on the technology front will put them ahead in the worlds of economics, culture, and politics. As a consequence of the further development of information technologies, new skills and knowledge must be obtained in order to preserve a privileged position in society. For those born in the Internet era it will be much easier to follow the logic of virtual reality.

The computerization process occurring in Poland and elsewhere could have important effects on political and economic norms. The fact that the Internet is truly a "world wide web" contributes to the declining significance of traditional national state institutions and policies. Ordinary people can now much more easily shop and conduct financial transactions anywhere in the world from the comfort of their home. Another way in which the blurring of national boundaries could affect economics and politics is when global groups, such as Greenpeace, that may be at ideological war with huge multinational corporations can reach out to global civil society actors as well as ordinary citizens, and urge them to boycott or avoid certain companies or products. Such new "meta-games" are based on the emergence of a cosmopolitan logic of power allocation. This cosmopolitan logic is strongly associated with the ability of global actors to use ICT and the media for information broadcasting and symbol transferring in the virtual World Wide Web (Beck 2005: 32–36).

Extensions and Proposals for Future Work

We make several suggestions for extensions of this project and future sociological work on the digital divide. Regarding the Polish case, we would like to further explore in greater detail the social, economic, and cultural contexts in Poland over the past twenty years or so, in order to better understand the specific circumstances that affected computerization there. Why did Poland outpace Hungary and Russia in IT acquisition during the 1990s, for example? And are there new trends, for example, economic developments, that may affect the future expansion of the IT sector in Poland? A comparison of Poland with Ireland or Finland would be very instructive as both countries are "European tigers" that have begun their success with development of the IT sector.

It would also be interesting to investigate a potential reciprocal causation effect between income and IT use and possession. The results presented here show that there is a connection between income (measured proximally) and PC possession. We feel confident that income affects the likelihood of becoming "wired," but the follow-up question, and one that is very interesting from a theoretical perspective, is: Does being wired—that is, highly connected to ICTs—have a positive effect on subsequent income at the aggregate level? We could assess the answer to this question using structural equation modeling.

Studying socioeconomic inequalities among social groups requires accurate and current information about the digital divide between people.

Clearly, the differentiation of people in terms of their access to and proficiency with digitally oriented information and communication technologies is relevant in contemporary analyses of social structure. There is a need for a standardized "digitalization index" based on quantitative (readiness and frequency) as well as qualitative (functions, aims, and dispositions) indicators of the digital divide. This digitalization index should be included in analyses of work situations and in the construction of new classifications of occupations and types of economic activity (see Porat 1974, 1977). The digital divide approach should be applied to the conceptualization of the "informational workforce," which will characterize a new component of economic social structure analysis.

The results of this study have interesting implications for theory on social stratification and the digital divide. The question was asked: Will the informatization of society in its various forms result in a digital divide that *transforms* social structures, in effect providing social opportunities for individuals who acquire human capital through IT proficiency, or will it result in the *preservation* of social hierarchy structures, allowing those who can "buy in" to the IT revolution to maintain their privileged positions by being ahead of the curve on technological innovations? By analyzing the connections between educational attainment and income and PC possession, this study sheds some light on this question. If educational attainment is more strongly associated with technology acquisition in the form of PC possession, this could imply that those who are at the forefront of learning and skill acquisition will ultimately gain an edge on the social ladder. This could result in a transformation of the social stratification system, effectively democratizing or leveling opportunities to the extent that those who acquire skills will get ahead. If income is more strongly associated with technology acquisition in the form of PC possession, this could imply simply that those who have more resources are more likely to acquire technological skills first due to those resources. If this is the case, then the digital divide would not imply a change in the social stratification system, but rather a preservation of its current structure.