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## **AGE AND THE USE OF VARIOUS SOURCES OF INFORMATION BY ADULT POLES**

### **Abstract:**

Information plays a more and more important role in the functioning of a modern society. Various traditional and up-to-date sources of information are available. The purpose of this paper is to evaluate the relations age - patterns of obtaining information by the adult Poles on the base of individual and aggregated data. The respondents are divided into ten-year cohorts. The associations are analyzed against this background by applying some visualization and multivariate statistical methods as the principal components analysis with biplot representation, trellis graphs and composite indicators. Three specific objectives are specified. The first one is to portray the situation in Poland in comparison to other European countries, the second one is to identify the relationships age - the use of the information sources and the third one is to evaluate the potential information gaps occurring between the cohorts.

### **Keywords:**

information sources, ageing, statistical analysis

## Introduction

Information is indispensable in the functioning of a modern society. Successful life in the information society requires certain behaviours and skills. The information is ubiquitous and provided by various means of communication which evolved strongly in the recent years. For the purpose of this paper the information sources are divided into two categories: traditional (i.e. TV, radio, books, newspapers, magazines, talks with friends and colleagues) and modern ones (i.e. Internet, e-mail, mobile).

The main objective of this article is to evaluate the relationships between the patterns of obtaining information and age. The study is focused on the adult Poles and the assessment is performed on the data coming from international surveys. Both aggregated and individual data are taken into account.

The main objective is pursued by three specific ones formulated as follows:

- to depict the pattern of information sources used in Poland in comparison to other European countries,
- to evaluate the differences in the use of information sources between various age groups,
- to assess the potential gaps of the access to information between various age groups, especially the one deriving from the ICT field.

The evaluation of the information sources interdependences is a multivariate task, hence chosen statistical and visualization methods are applied to explore the associations. The principal components analysis is used as a statistical procedure focused on the dimensionality reduction of the multivariate datasets. Several graphical approaches as biplot representation and trellis graphs are chosen to visualize the relationships among the objects, variables or categories.

## 1. Data and methods description

The analyses are based on the data from the two latest waves of the World Values Survey: Wave 5 which took place in the years 2005-2009 and Wave 6 which took place in the years 2010-2014<sup>1</sup>.

The use of the following information sources is taken into consideration when the international comparisons are made (as provided in the Wave 5 of the World Values Survey (WVS, 2015)):

- daily newspaper,
- news broadcasts on radio or TV,
- printed magazines,
- in depth reports on radio or TV,
- books,
- Internet, E-mail,

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<sup>1</sup> WVS (2015). World Value Survey 1981-2014 Longitudinal Aggregate v.20150418, 2015. World Values Survey Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSYSTEMS Data Archive, Madrid, Spain. EVS (2011). European Values Study 1981-2008, Longitudinal Data File. GESIS Data Archive, Cologne, Germany, ZA4804 Data File Version 2.0.0 (2011-12-30) DOI:10.4232/1.11005.

- talk with friends or colleagues.

The answers to the questions concerning these sources were defined in the survey as binary: "used last week" vs. "not used last week". Thus, the percentages of the respondents who used the particular items last week are considered as variables for the comparisons across European countries.

More comprehensive information was obtained from the Wave 6 of the World Values Survey (WVS, 2015) as the frequency of the use of each information source category was evaluated in five-point ordinal scale (never, less than monthly, monthly, weekly, daily). In this case individual data are used for the comparison of Poles' behavior according to the age. The following information sources are taken into account: TV news, daily newspapers, printed magazines, radio news, talks with friends, Internet, mobile, e – mail. The individual data are divided into seven cohorts:

- 1925-1934,
- 1935-1944,
- 1945-1954,
- 1955-1964,
- 1965-1974,
- 1975-1984,
- 1985-1993.

Chosen analytical methods are applied to examine the relationships among various sources of information used by the adult Poles. The principal components analysis is applied to search for a simpler representation for a set of intercorrelated variables by deriving new uncorrelated variables from the original ones (Afifi and Clark, 1996, p.330). As a result, only a small set of the new variables (components) covering most of the information is considered what facilitates the interpretation of the dataset structure (Bartholomew et al., 2008, p. 117).

According to Du Toit, Steyn and Stumpf (1986, p.1) there are three general ways of statistical communication complementary to one another: description in words, tables containing data and graphics. Nowadays the visual information becomes more and more important, therefore new visualization techniques are introduced and the existing ones are improved. The substantial outcomes from the principal components analysis can be presented by a graphical representation called biplot proposed by Gabriel (1971) which allows to illustrate the relations among the variables and objects simultaneously. Biplot analysis is described in details in recent works written by Greenacre (2010) and Gower, Lubbe and Le Roux (2011). The most important interpretation rules can be summarized as follows (cf. Kroonenberg 2008, pp.497-498):

- objects are represented by points,
- variables are represented by vectors (arrows),
- a small angle between variable vectors corresponds to a strong association of variables,
- a larger projection of an object on a variable vector indicates a bigger deviance of the object from the average value of the variable.

A versatile approach to biplot visualization is accessible via R program allowing for in-depth exploration (La Grange, Le Roux and Gardner-Lubbe, 2009). In this paper such features as objects projections, axis highlightings as well as points densities mapping are used.

Multiple plots are displayed in a rectangular array of panels called trellis graphics which is very useful to present many charts "in an effective manner, with properly coordinated scales, aspect ratios, and labels" (Sarkar, 2008, p.1).

The last methodological approach in this study is a composite indicator construction for evaluating the gap in ICT usage between the cohorts. A composite indicator (or index) is a mathematical combination of a set of variables designed to summarize a system described by many aspects (Saisana and Tarantola, 2002, p. 5). Such indicators simplify the interpretation of multidimensional issues by providing the big picture and reducing the size of original list of variables (Saisana and Tarantola, 2002, p. 5). There are many proposals for composite indicators construction (see Gatnar and Walesiak, 2004, pp.351-362) varying according to normalization procedures and aggregation methods. For the purpose of this research the composite indicators are calculated as the weighted arithmetic mean of the normalized variables of interest - i.e. by the formula (1).

$$CI_i = \sum_{j=1}^k z_{ij} w_j \quad (1)$$

where:

$z_{ij}$  - the normalized value of the variable  $j$  in object  $i$ ,  $w_j$  - the weight of the variable  $j$  ( $\sum_j w_j = 1$ ),  $k$  - number of variables included in the indicator.

The normalization of a particular variable is performed by the formula (2):

$$z_{ij} = \frac{x_{ij} - \min_i \{x_{ij}\}}{R} \quad (2)$$

where:

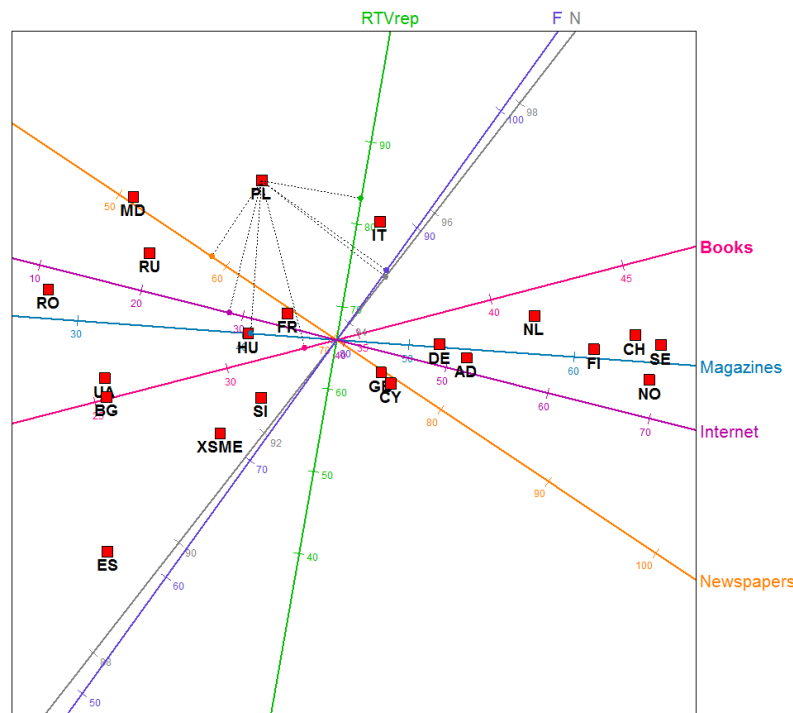
$x_{ij}$  - actual value of the variable  $j$  in object  $i$ ,  $R$  - range of the variable  $j$ .

The weighting scheme is proposed according to the importance of the variables.

## 2. Information sources used last week – Poland compared to other European countries

A comparison of the usage of various information sources is a multivariate task. For this reason, the assessment of the situation in Poland in relation to other European countries was carried out with the application of the principal components analysis. The input data were response rates "used last week" for each source of information in twenty one European countries which participated in the Wave 5 of World Values Survey.

The principal components analysis allowed to reduce the multidimensionality. Two first components capture 85,94% of the total variance. Hence, the representation in two-dimensional space may be considered as good. A biplot visualization (La Grange, Le Roux and Gardner-Lubbe, 2009) is applied to show both elements – variables (information sources) and objects (countries) at one picture (Figure 1).

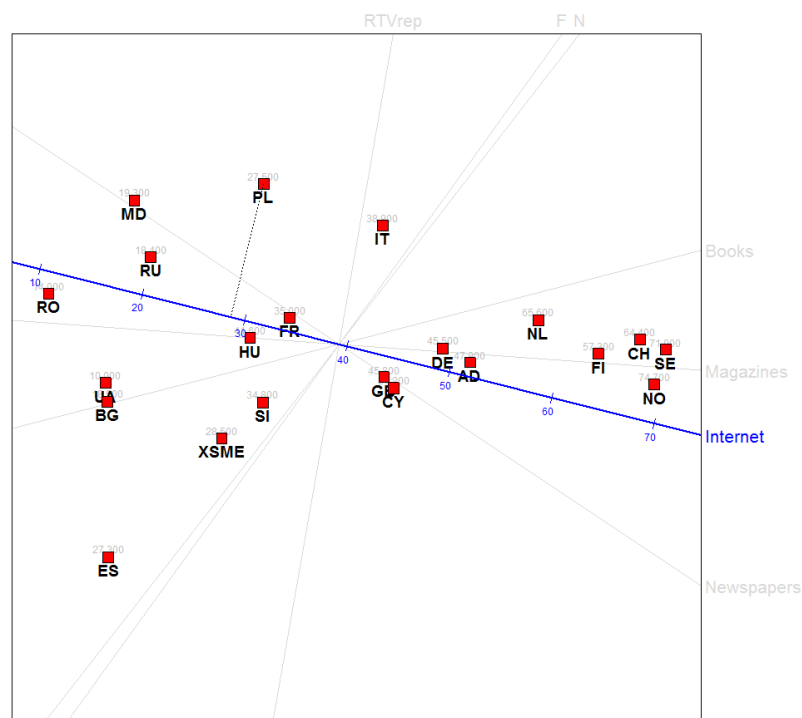
**Figure 1: PCA biplot illustration with projections of Poland**

Abbreviations: RTVrep - in-depth reports on radio and TV, N - news broadcasts on radio or TV, F - talk with friends or colleagues; AD - Andorra, BG - Bulgaria, CH - Switzerland, CY - Cyprus, DE - Germany, ES - Spain, FI - Finland, FR - France, GR - Greece, HU - Hungary, IT - Italy, MD - Moldova, NL - Holland, NO - Norway, PL - Poland, RO - Romania, RU - Russia, SE - Sweden, SI - Slovenia, UA - Ukraine, XSME - Serbia and Montenegro

Source: own elaboration based on WVS Wave 5 data

The association among books, magazines, Internet and newspapers usage is mostly represented by the first dimension. The second dimension corresponds to news broadcasts as well as in-depth reports on radio and TV and talks with friends and colleagues.

The dashed lines outgoing from the point PL represent the projections of Poland's position on the solid lines illustrating various information sources. The Poles use TV/radio and talks with friends and colleagues as the information source more frequently than the average (given in the origin). On the other hand, books, magazines, newspapers and Internet are used more rarely. A very interesting projection concerns the Internet usage (Figure 2). This shows a poor position of Poland in application of the modern means of the communication as compared to other European countries, especially post-industrial ones. The best performers in this field are Norway, Sweden, Finland and Switzerland.

**Figure 2: Position of Poland on the axis representing Internet usage**

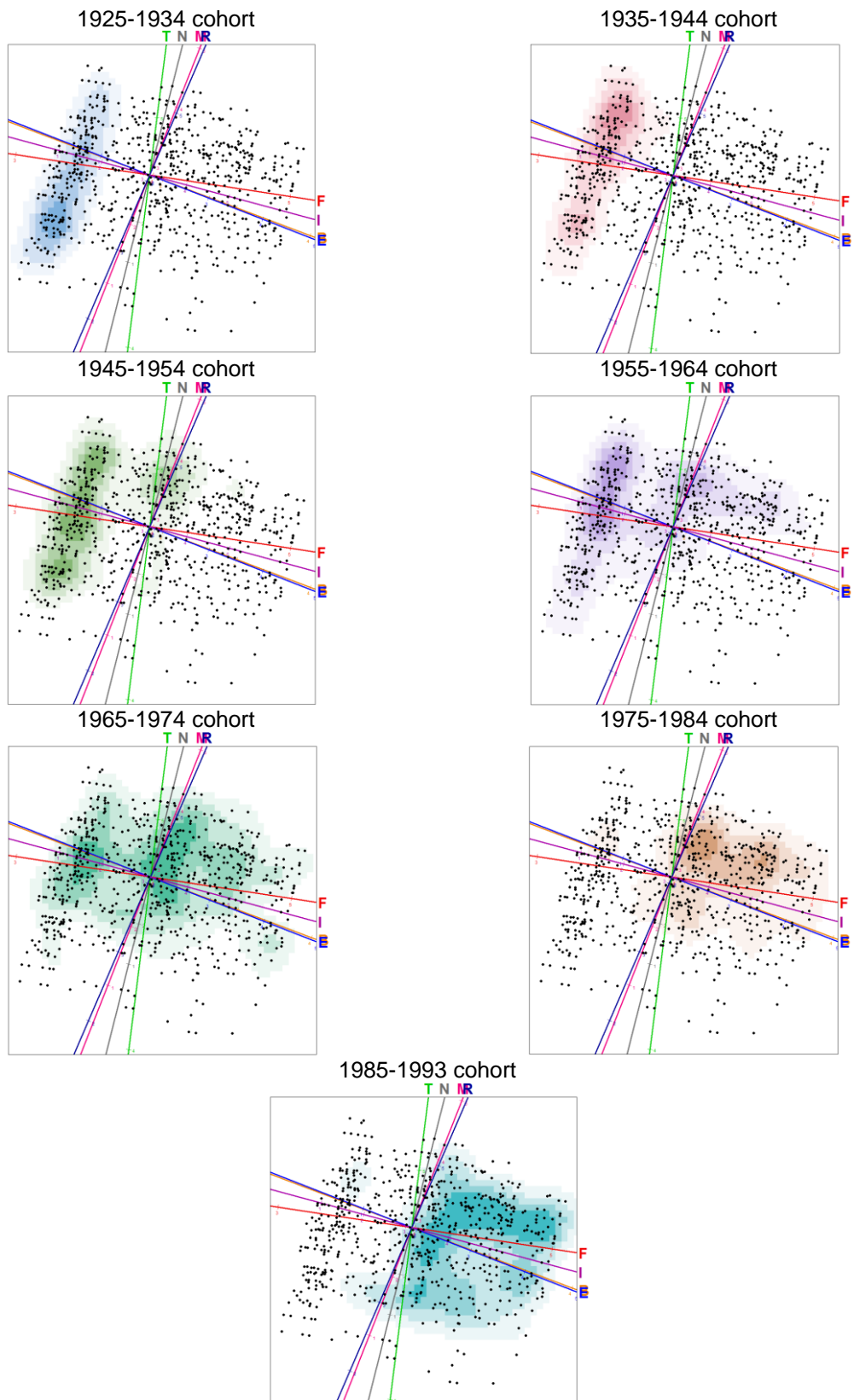
Source: own elaboration based on WVS Wave 5 data

Some regularities can be indicated when comparing the situation in Poland with other European countries. Firstly, there are relatively low percentages (lower than average) of the use of these sources of information, which are mainly linked to the first principal component, i.e. daily newspaper, printed magazines, books, Internet, e-mail. Secondly, there are relatively high percentages (greater than average) of the use of these sources of information, which are mainly associated with the second principal component, i.e. news broadcasts on radio or TV, in depth reports on radio or TV, talk with friends or colleagues. It might be interesting that the highest percentage of adults declaring getting information from in-depth reports on radio or TV was observed in Poland. The analysis of the position of objects (countries) in the biplot leads to the conclusion that the point representing Poland is located near the points illustrating other post-communist countries. This suggests similar patterns of the use of information sources. It is especially evident in relation to the first principal component, which clearly separates the post-industrial countries from the post-communist ones. It is noteworthy that in the post-communist countries the Internet as an information source is rarely declared. That proves the existence of a significant distance to other well-developed European countries in the information access domain.

### 3. Patterns of the use of various information sources in ten-year cohorts in Poland

Principal components analysis and biplot representation were also applied to search patterns in the non-aggregated dataset (i.e. raw individual data) derived from Wave 6 of World Values Survey.

**Figure 3. PCA biplot elaborated on the base of the individual data with point densities corresponding to the ten-year cohorts**



Abbreviations: T – TV news, N – daily newspapers, M – printed magazines, R – radio news, F – talks with friends, I – Internet, B – mobile, E - email

Source: own elaboration based on WVS Wave 6 data

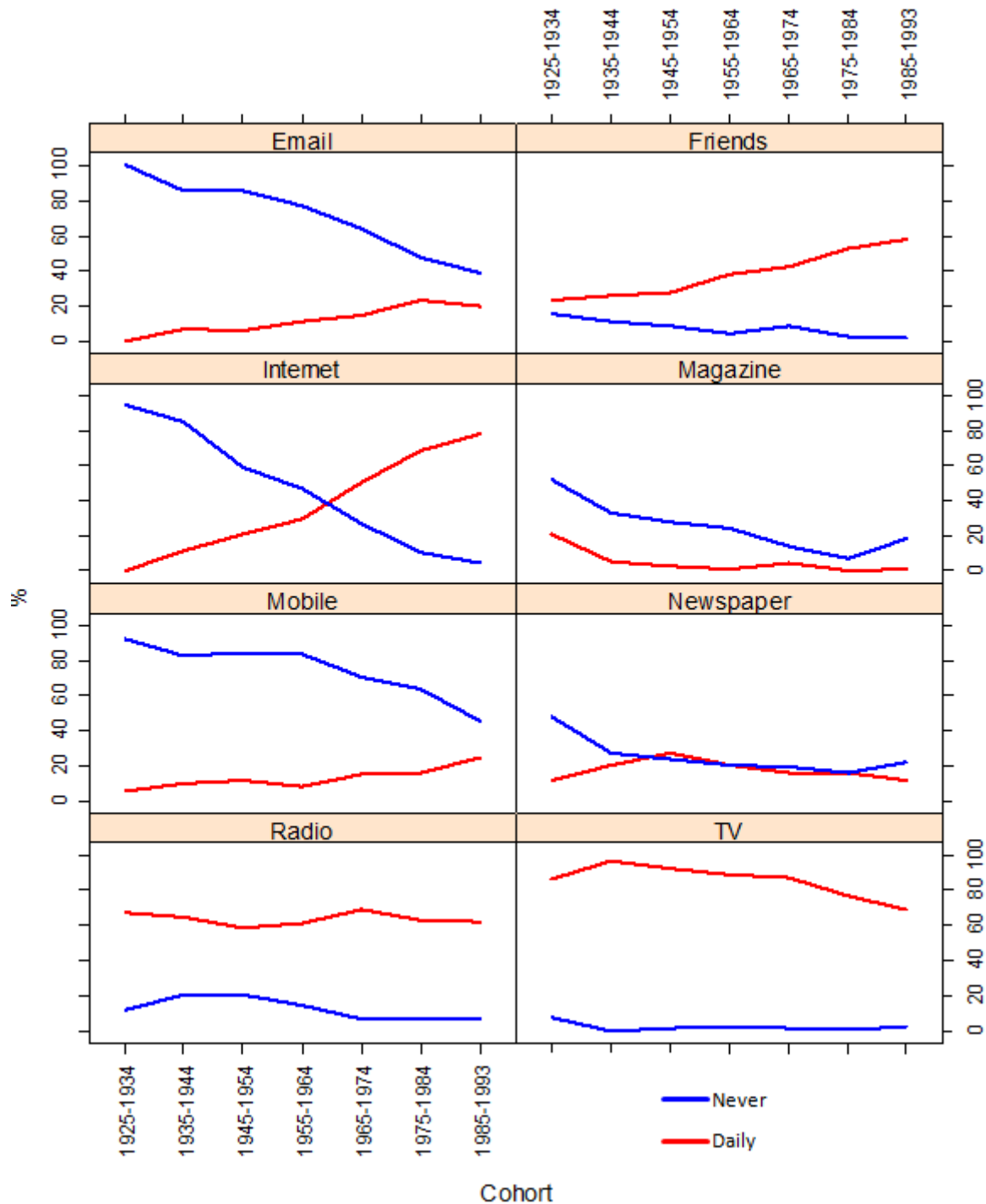
The intensity of the use of various information sources was evaluated by respondents in five-point scale starting from "never" and ending at "daily". As the measurement scale is ordinal the application of the principal components analysis should be treated with caution. As some researches claim (see Górnjak, 2000, pp. 312-313), if the scale is at least five-point and represents attitudes (as in Likert scale) the application of this method may be justified. It should be underlined that such an approach is not always accepted. Nevertheless, it seems that the principal components analysis can play the role of exploratory and preliminary data analysis under such conditions and is used in that way in this paper in case of the individual data. The purpose is to obtain a general insight into dataset structure and not to draw precise conclusions.

PCA biplots with point densities (La Grange, Le Roux and Gardner-Lubbe, 2009) corresponding to the cohorts are presented in Figure 3. The representation is rather poor as two first components represent 52,29% of the total variance. The first component is highly correlated with Internet usage, talks with friends, mobile and e-mail, so it may be described as ICT use and personal talks aspect. The second component is related mostly to TV and radio news, daily newspapers and printed magazines, so it may be called as traditional means of communication excluding direct talks with others. The density estimate was performed for each age interval separately to explore differences across the cohorts. The results are marked in colour in Figure 3. It is apparent that there are substantial differences concerning the position of groups with respect to the first dimension while the second dimension brings less information. Interesting regularities can be found when comparing the cohorts. The first two cohorts are considerably shifted to the low values of the first component. The oldest persons rarely use modern technologies to gain information and probably have less social contacts allowing for exchanging information with other people. This indicates a risk of social and digital exclusion. The picture starts to change from the 1945-1954 cohort. ICT use in terms of the information source as well as personal talks become more and more frequent. The last two cohorts (i.e. the youngest persons) are shifted considerably to the high values of the first component. Moreover, the 1985-1993 cohort is more likely not to use traditional sources of information represented in the second dimension. This general overview of the situation leads to the conclusion that there are generational changes in the access to the information sources.

In order to depict the above-mentioned regularities a comparison of the percentages of extreme responses ("never" and "daily") across the cohorts is shown in Figure 4 which is made in form of the trellis graphics. The most interesting tendencies can be noticed in case of the Internet and e-mail use as well as talks with friends and colleagues. In the case of modern technologies the declaration of lack of the use reaches almost 100% in the oldest cohort. The percentage of not using such tools at all decreases with age. It is particularly visible in the case of the Internet. Declaration of the daily use in order to gain information grows rapidly in the subsequent cohorts. Constant but smaller increases are also evident in cases of email, mobile and talks with friends and colleagues.



**Figure 4. Information sources – Never vs. Daily usage in ten-year cohorts**



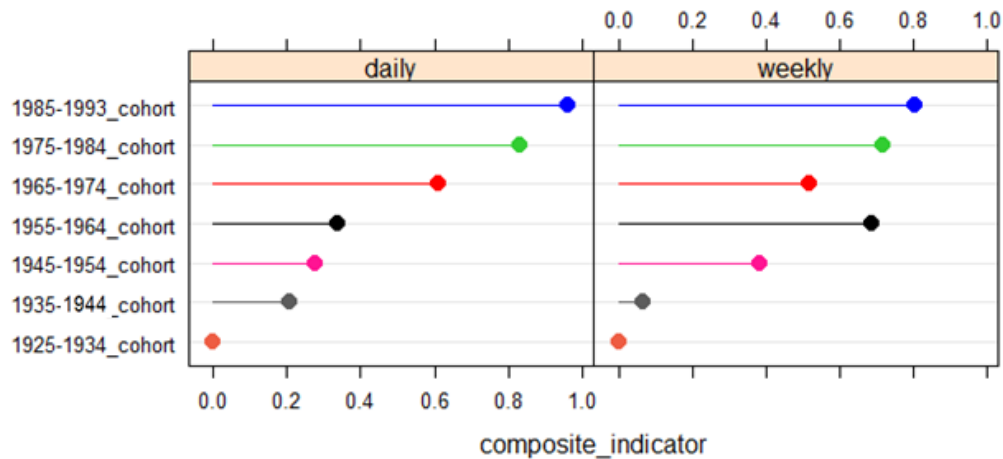
Source: own elaboration based on WVS Wave 6 data

#### 4. The ICT usage gap evaluation

As it was shown above, the ICT field seems to be the most differentiating information source with respect to the age of the respondents. A composite indicator is proposed to compare the ICT usage in obtaining information and to evaluate the gap across the cohorts. The indicator is built on the base of three ICT means: Internet, mobile and e-

mail (% of answers in cohorts relating to daily and weekly use). Data concerning these three dimensions were normalized by the formula (2) described in the paragraph 1. The composite indicators (CI) were calculated as the weighted arithmetic mean of the three normalized values (according to the formula 1). As the Internet use is supposed to be more important than the two others the following weighting scheme is proposed: Internet 0,5; email 0,25; mobile 0,25. The composite indicators were calculated for the answers „daily” and „weekly” separately. Each indicator belongs to the interval  $<0,1>$ . The higher CI value, the higher overall ICT use. The CI values are summarized in Figure 5.

**Figure 5. Composite indicators for daily and weekly ICT usage in ten-year cohorts**



Source: own elaboration based on WVS Wave 6 data

There is an apparent relationship between age and everyday use of modern technologies in order to obtain information. The younger the person, the greater attachment to the ICT tools. Poles from the oldest cohort do not use such methods of communication at all. While there are no significant differences across the cohorts 1935-1944, 1945-1954 and 1955-1964, a substantial increase in everyday use of modern communication tools appears between the 1955-1964 and 1965-1974 cohorts. Undoubtedly, there is an ICT gap between the three youngest cohorts and the others. Indicators for weekly use of modern communication technologies indicate that the largest information gap applies to people born in the years 1925-1944 as compared to younger persons. The lack of the ICT knowledge can contribute to a social exclusion of the elderly, especially in the era of the information society. It is therefore necessary to take measures for the promotion of the modern information technologies among the oldest citizens.

## Conclusions

The traditional sources of information which do not require reading (TV, radio as well as talks with friends and colleagues) are used in Poland more often than on average. On the other hand, such sources as the Internet, books, magazines and newspapers are much less frequently used, especially when compared with post-industrial European countries. The overall pattern of the use of information sources in Poland is similar to the situation in other post-communist countries.

The use of information sources depends strongly on age. This is particularly evident in the field of modern technologies. The ICT tools are the domain of young people. Older people rarely or never benefit from modern information technologies, what may expose them to a social exclusion.

## Acknowledgment

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