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Changing Trends in ICT Use - A Generation Y Analysis

LÁSZLÓ BERÉNYI, Ph.D.
ASSOCIATE PROFESSOR
UNIVERSITY OF MISKOLC
e-mail: szvblaci@uni-miskolc.hu

SUMMARY

The development in recent years of Information and Communication Technology (ICT) tools and equipment is notable. The question arises whether user behaviour follows technical progress. Statistics prove that the spread of the Internet in Hungary, especially the Mobile Internet, follows the EU trend. At the same time, the changes in equipment use are less spectacular. The paper analyses the data of a survey conducted among the business students of the University of Miskolc in 2012 and in 2015 related to the order of preference for some ICT tools. Empirical results confirm that changes in the utilisation of ICT tools are much slower than the appearance of new tools and solutions in the market; due to the increasing popularity of smartphones, the possibility of utilising them both in higher education and at work should be considered.

Keywords: ICT tools, preference analysis, digital competence
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INTRODUCTION

Research activities in field of Information and Communication Technology (ICT) possibilities may serve several purposes. Expanding trade flow or establishing new software developments are obvious scopes, but also social aspects of the utilisation have an increasing importance. Consideration of user skills and intention to use ICT tools must have a similar priority in order to achieve evolution.

Nowadays ICT tools extend throughout our work and lives, including news reading, keeping in contact with relatives or friends, job searching, placing orders, etc. Computers or even mobile phones are essential during the mentioned activities. Higher education, among other sectors, is interwoven with ICT solutions: e-administration, e-learning systems and materials, video conferences and emails are common. However, the availability of the technology by itself is not enough for achieving a breakthrough. It is necessary to develop ICT systems, the learning content supply and the personal level of knowledge and competences in a coordinated manner.

Generational theory (Coupland 1991; Strauss & Howe 1991) offers a professional background for explaining typical ICT user profiles and behavioural patterns. Attitudes to information technology (IT) and ICT significantly determine differences between the characteristics of the latest generations. This is especially true in case of the related labour market research (see Szlávicz & Szretykó 2013; Törőcsik 2015). Studies dealing with Generations X, Y, Z and Alpha designate different years of birth of the persons belonging to each group. This is due to the local characteristics of social and economic structures. A major issue is that Hungarian diffusion of personal computers was delayed compared to Western Europe or the USA. In Hungary, people born between 1982 and 1995 are classified as Generation Y (Pais 2013).

The aim of the present study is to analyse some aspects of the changes of ICT usage among higher education students belonging to the late representatives of the Generation Y. Changes in the preferred data storage tools and computer type are representative indicators of the topic.

The paper summarises the general trend and the results of a pilot survey including the business students of the University of Miskolc.

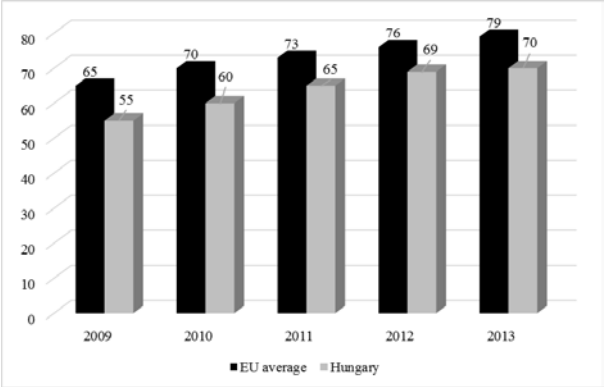
USE OF ICT TOOLS

General Trends in Household Use

Regular reports of the Hungarian Central Statistical Office (KSH) in the field prove a clear improvement in

computer usage among households (KSH 2016). 76% of the population were effective (active) computer users in 2015, i.e. they used a computer at least once in a three-month period. While the indicator is lower than the EU average (83%), a continuous increase can be observed in comparison with the previous years. 56.8% of the households had a desktop computer in 2009 and this ratio had barely changed to 2013 (58.3%). Nevertheless, the share of portable computers has been growing steadily; the ratio has changed from 21% to 41.6% in the period.

Using ICT tools is usually associated with using the Internet. The growing number of households with Internet access is a positive tendency. Hungary lags behind the EU average, but the headway is visible (Figure 1).



Source: KSH, 2016

Figure 1. Household internet access in Hungary and the EU (data in %)

The KSH report on telecommunications, Internet and TV services (KSH 2016) pointed out that there were 8.7 million Internet subscriptions in Hungary in the 3rd quarter of 2015, which is 35.9% higher than in the same period of 2013. Wired internet bandwidth has begun to grow dynamically; 75% were over 2 Mbit/s, 49% over 10 Mbit/s and 14% over 100 Mbit/s in 2016. The ratio of the latter category exactly doubled from the same period of the previous year. Development of data traffic on wired Internet is remarkable. The traffic was about 383 thousand Terabytes, which means a 34% increase over one year. Expansion has accelerated, which is proved by the fact that the value of the indicator was 39 thousand Terabytes in 2014 fourth quarter and 14.4 thousand Terabytes in 2010 fourth quarter based on data from KSH (2015).

Furthermore, Internet subscriptions included 5.9 million Mobile Internet subscriptions. The growing popularity of mobile use is also reflected in the fact that four-fifths of conversations were carried out using mobile phones.

Sending and receiving e-mails were the most popular computer activities in 2015. 93% of the 16 to 74-year old population within the group of effective Internet users reported using e-mail. There was an increasing ratio of users who made Internet phone calls (from 37.2% in 2013 to 54.7% in 2015) as well as participation in social networks (from 77.8% in 2013 to 83.4% in 2015). Browsing Wikipedia also became more popular (changing from 40.4% in 2013 to 59.8% in 2015).

General Trends in Company Use

Sasvári (2012a, 2012b) analyses the use of ICT tools on the corporate level. According to his results based on an international survey, the level of utilisation is diverse, especially with regard to company size. Small- and medium-sized companies were lagging in using information systems (Sasvári & Wolf 2014). Of course, this does not entail the total neglect of IT services and ICT tools, but the depth and scope of utilisation is fairly questionable. More than four-fifths of the corporations in the sample (Sasvári, 2012b) have a web page in 2010 and they used Internet for advertising products and services. 60% of micro- and small companies have had a product or service advertised on the Internet. Moreover, e-banking was taken advantage of by 80% of micro and 85% of small companies.

KSH (2014, 2016) results confirm Sasvári's findings. 91% of the companies used the Internet in 2013, and 27% of them had broadband Mobile Internet access. However, there are areas for improvement, including:

- low utilisation of cloud computing: only 26.2% of large companies (over 250 employees) took advantage of any cloud-based services (the national average ratio is 11.6%),
- corporate web pages focused on product and service information; on-line ordering was available in every fourth to fifth case, however every third company managed its purchasing also this way,
- an enterprise resource planning system was installed by 70.5% of large companies but by only 37% of medium-sized (50-249 employees) and 12.1% of small firms (less than 50 employees) (KSH 2016).

Statistics clearly confirm that the small companies utilise ICT at a lower level than large ones. In my opinion, the reason for this is not mainly the availability of the tools or even the financial possibilities. A large company can define a number of repeatable processes, which are manageable by IT systems, while a smaller company more rarely encounters with equally repetitive challenges. In these cases, individual treatment of the problem with marginal support of ICT can be more appropriate in several ways, including the costs. However, this means that personal IT competencies have fundamental importance in solving the problems.

RESEARCH SAMPLE AND METHOD

Research Goals and Limitations

Relevant literature and related statistics verify a dynamic expansion of ICT tools. Technological development may lead to changing user behaviour, as well

as there being also an opposite effect. I believe that the investigation of changes in preferences related to ICT tools can contribute to establishing more effective development action. I started a survey in 2012 in order to explore the ICT competencies and attitudes of higher education students. The results allow us to designate new ways of educational methodology in practice, while the information is also valuable for the labour market.

Empirical results in this paper highlight the data storage tools and types of computer preferred by the respondents. Results in this paper are based on the business students of the University of Miskolc. Although the sample is not representative and generalisation of the statements is not available, its findings can be utilised.

Research Sample Characteristics

The data collection periods of the present analysis were in 2012 (n=437) and in 2015 (n=294). Some data of the sample are summarised in Table 1.

Table 1
Research sample data

	2012	**2015**
Female	62.5%	53.4%
Male	37.5%	46.6%
Full-time student	66.1%	85.0%
Part-time student	33.9%	15.0%
Weekday time spent with computer (average)	4.79 hours	4.81 hours
Weekend time spent with computer (average)	4.01 hours	5.03 hours

Source: own edition

The time spent with computer activities per day was quite much in each year (Table 2). Checking the data by gender, in case of male respondents there are higher values but the differences are statistically not significant. Average weekday time spent with computer activities was higher in the group of part-time students but the weekend time was higher in the group of full-time student (some ANOVA results show (*) significant differences).

Table 2
Time spent with computer work by sub-samples

		Weekday (hours)	ANOVA F	ANOVA Sig.	Weekend (hours)	ANOVA F	ANOVA Sig.
2012	Female	4.85	.286	.593	3.81	3.949	.048*
	Male	4.64			4.31		
2015	Female	4.74	.120	.729	4.76	2.032	.155
	Male	4.88			5.34		
2012	Full-time	3.91	47.857	.000*	4.49	33.986	.000*
	Part-time	6.50			3.05		
2015	Full-time	4.52	11.541	.001*	5.17	2.643	.105
	Part-time	6.45			4.27		

Source: own edition

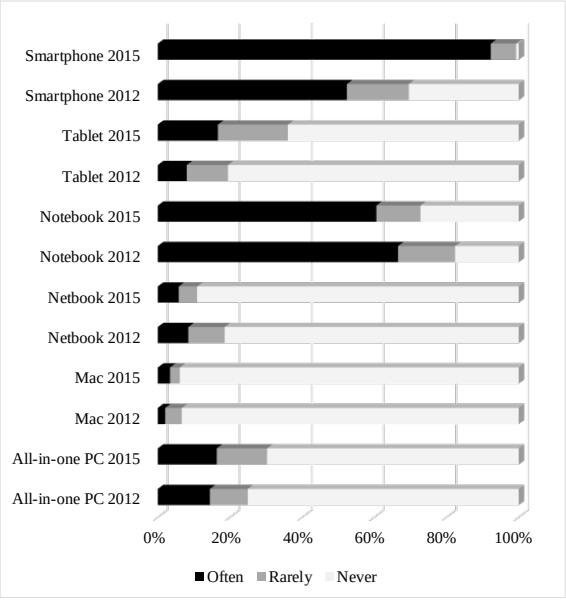


Figure 2. Frequency of ICT tools (%)

Figure 2 compares the use of some tools in the two periods. Beside the overall state of users' preferences there are some notable results:

- netbooks have not had a significant share and their popularity is fading,
- notebooks are preferred but the ratio of both frequent and occasional users decreased slightly,
- popularity of tablets has increased, but prevalence was only 16.6% in 2015,
- use of smartphones show dominant progress; the smartphone has become the ultimate tool of access to ICT.

METHODS

The online survey was prepared for preference analysis. The respondents were asked to mark the more preferred item pairwise. In case of data storage tools the items (for 6 comparisons) are as follows:

- memory card,
- external HDD,
- USB flach memory
- on-line (cloud) data storage.

Items related to the computer type (for 10 comparisons) are as follows:

- tablet
- netbook
- notebook
- smartphone
- desktop PC

Kendall (1970) proved the mathematical basis of pairwise comparison and introduced indicators for evaluating the quality of the preference orders. Kindler and Papp (1978) collected some applications for describing the preference orders on interval scale, including the Guilford transformation. One step of the Analytic Hierarchy Process (AHP) by Saaty (1980) offers a solution presenting the preference orders on a ratio scale, which allows the direct comparison of the results between various sub-samples. The results in this paper include:

- preference frequencies of the items, preference orders and ratio of weights,
- calculating the personal level of consistency (K) in the order of the factors ($0 \leq K \leq 1$, where 0 is the complete absence of consistency and 1 is the complete consistency; the latter means that the respondent has a clear list of preferences),
- group level consensus by Kendall's coefficient of concordance for pairwise comparison (ν) (Kendall, 1970), including the cases $K \geq 0.75$.

The maximum level of Kendall's coefficient of concordance is 1, while the minimum is not fixed, it depends on the number of cases (m): $\nu_{even} = -1/(m-1)$ and $\nu_{odd} = -1/m$ (Kindler & Papp, 1978:49). In order to ensure the comparison, I calculate a corrected coefficient of consensus as:

$$\nu_{corr.\ i} = 100 * \frac{\nu_i - \nu_{min}}{1 - \nu_{min}} \qquad (1)$$

The calculation of the significance (u) test is based on occurrences and possible sum of values below the main diagonal in the aggregated preference matrix, i.e. the number of non-preferred incidences. The details of the procedure can be found in Kindler and Papp (1978:187). In case of high u values ($u > 1.65$) the result is statistically significant.

A step of the AHP method by Saaty (1980) determines the weights of items based on the eigenvector assigned to the highest real eigenvalue of a pairwise comparison result matrix. These weights are comparable between sub-samples after normalisation. Rapcsák (2007) shows that there is only one non-zero eigenvalue if the matrix is prepared as in (2).

$$\begin{bmatrix} 1 & \frac{w_1}{w_2} & \dots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & 1 & \dots & \dots \\ \dots & \dots & 1 & \dots \\ \frac{w_n}{w_1} & \dots & \dots & 1 \end{bmatrix} \qquad (2)$$

RESULTS

Preference Order

The preferred data storage methods were USB flash memory and on-line solutions (cloud storage) the less one in 2012. The order is similar in 2015, but the ratio of the marking show a changing structure. The relevancy of memory cards decreased; and the popularity of on-line data storage expanded (Figure 3). Notebook computers were the preferred computer type considered by the respondents in both years. Netbooks and desktop PCs became less popular, and tablets and smartphone were appreciated, although the increase in the share of tablets was not really noticeable (Figure 4).

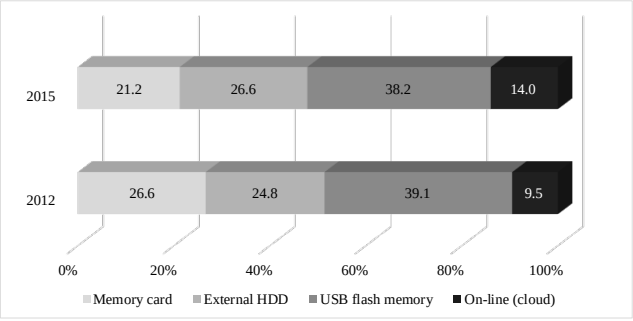


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Figure 3. Preferences about data storage tools (data in %)

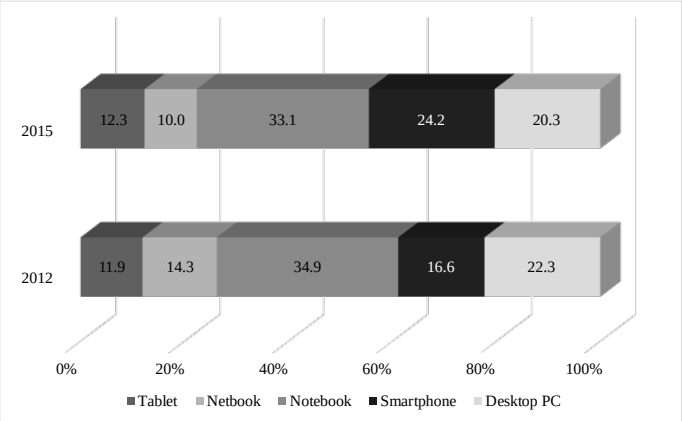

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Figure 4. Preferences about useful computer types (data in %)

Table 3
Results of preference order calculations

Data storage		**Type of computer**	
2012	**2015**	**2012**	**2015**
1. USB flash memory (53.9)	1. USB flash memory (52.3)	1. Notebook (68.0)	1. Notebook (54.1)
2. Memory card (21.1)	2. External HDD (22.5)	2. Desktop PC (13.3)	2. Smartphone (20.7)
3. External HDD (18.9)	3. Memory card (15.4)	3. Smartphone (7.9)	3. Desktop PC 14.0)
4. On-line (cloud) (6.0)	4. On-line (cloud) (9.7)	4. Netbook (5.5)	4. Tablet (6.4)
		5. Tablet (5.3)	5. Netbook (4.8)

Source: own edition

The preference orders and ratio of weights (presented on a 0-100 scale) are summarised in Table 3.

LEVEL OF CONSISTENCY AND CONSENSUS

Reliability of a preference order can be questionable. The personal level of consistency allows us to evaluate whether a respondent has a clear preference order. 91.9% of the respondents in 2012 and 94.9% in 2015 had a clear preference order (K=1) about the data storage tools.

The list of useful computer type included more items that allows more category levels in calculating consistency (K), but also in this case the ratio of respondents with a clear preference order (K=1) was high. The survey results were 82.6% in 2012 and 79.9% in 2015. Moreover, the ratio of cases K>0.75 was 91.1% in 2012 and 91.5% in 2015.

It is interesting to check whether the gender or full-time/part-time status could have a group forming effect on the consistency. The Chi-square test of cross tabulation does not show any significant effect. Both grouping factors have a significant effect in case of the useful computer type. Responses of female respondents and full-time students show lower levels of consistency.

The group level of consensus is determined for cases K>0.75. Tables 4 and 5 summarise the results of some sub-samples (n shows the number of responses in the sub-sample). Each result is significant.

Table 4
Group level consensus on data storage tools

Data storage		n	v	v_{corr} (%)	d_f	u
Total sample	2012	402	.294	29.57	6.045	34.531
	2015	279	.208	21.11	6.065	23.350
Female	2012	253	.303	30.53	6.072	27.229
	2015	148	.233	23.85	6.124	17.368
Male	2012	149	.297	30.20	6.123	20.044
	2015	131	.195	20.11	6.140	14.563
Full-time	2012	266	.282	28.45	6.068	26.916
	2015	238	.208	21.11	6.076	21.321
Part-time	2012	136	.319	32.38	6.135	19.804
	2015	41	.221	23.97	6.469	7.704

Source: own edition

Table 5
Group level consensus on the preferred type of computers

Type of computer		n	v	v_{corr}	d_f	u
Total sample	2012	398	.291	29.28	10.076	44.026
	2015	269	.305	30.77	10.11	36.454
Female	2012	239	.273	27.62	10.127	32.102
	2015	143	.320	32.46	10.214	26.279
Male	2012	159	.341	34.48	10.192	28.927
	2015	126	.312	31.71	10.243	24.082
Full-time	2012	259	.285	28.73	10.117	34.343
	2015	127	.316	32.18	10.241	24.407
Part-time	2012	139	.309	31.36	10.220	25.337
	2015	142	.311	31.61	10.215	25.768

Source: own edition

DISCUSSION

Comparing the General Trends and Survey Results

IT and ICT appears in both personal and corporate everyday activities. Technological novelties are difficult to follow; physical product life nowadays is perceptibly longer than the new product versions on the market. Statistics show a huge and dynamic evolution of ICT tools and possibilities in the 2010s, including changes in user behaviour. The availability of Internet access has become general and its utilisation is now essential in personal and business contacts. However, the level of utilisation is diverse. Although the business administration of large companies widely depends on ICT, smaller ones enjoy fewer of the achievable benefits. Utilisation if often limited to presenting general and product information to customer; however, e-solutions in purchasing are appreciated.

Extension of data traffic, especially the mobile data traffic, is remarkable. This represents new horizons in information exchange because it eliminates the barriers of immobility. The recent mobile phones are ready to substitute for a desktop PC or notebook is many functions.

Generational theory draws up that Generation Y was born in the age of computers, Generation Z was born with the Internet, and Generation Alpha members are born into a permanent on-line era. The last group includes small children who are currently of less interest in terms of the aims of the presente paper, which focusses on higher education or the labour market. However, their attitudes to ICT may move forward the methodological developments for other generations. An Alpha child uses services and databases by touch screens without any knowledge of the technology or design behind it. These children perceive ICT as natural and obvious. I believe that service design shall give similarly simple utilisation possibilities for older generations as well, i.e. the user's attention must not devoured by the operation of the ICT tool, including the hardware or the service framework, rather the focus must be kept on the content of the service.

The empirical results of my survey are in harmony with the general trends. "Smartphoning" spread remarkably between 2012 and 2015. The fact that 89.1% of the respondents considered themselves as regular users in 2015 can be regarded as a ground-breaking result, especially considering that the ratio was 52.4% in 2012. The share of tablets is below my expectations. However, the ratio of both regular and occasional users doubled during the period, while the ratio of non-users decreased

from 80.5% to 63.9%. Notebooks were the most popular both in 2012 and in 2015, even though the ratio of regular users decreased from 66.5% to 60.5%.

The survey asked about the time spent with computer activities (see Table 1). The average value of 4 to 5 hours per day is quite much. The survey shows an increase, but there is a significant change between the years only in case of weekend usage. Checking the results by sub-samples, on weekdays the part-time students spend more time in front of the computer but it is still the opposite on weekends.

EVALUATION OF CHANGING PREFERENCES

The core element of the analysis was the calculation of preference orders related to data storage tools and useful type of computers. USB flash memory still remained the preferred data storage tool in 2015. The popularity of on-line data storage has increased greatly but its weight lags behind USB flash memory even in 2015 (9.7% versus 52.3%).

The preferred computer type was the notebook in both years. There is no change in the weight of desktop PCs, but its rank in the preference order dropped on the list. Usefulness of smartphones shows a notable step forward (the weight moved from 7.9 to 20.7).

There is a surprisingly high ratio of respondents who have a clear preference order in either year or topic analysed. Despite this, the coefficient of concordance shows a quite low group level of consensus. In the case of data storage tools, the consensus decreased from 2012 to 2015. This may be assign that the current technology-generated change in preferences is not finalised yet, and that adaptation takes place more slowly than the development of the technical background. This phenomenon is observed in each sub-sample of the research.

CONCLUSIONS

There are two main conclusions based on the survey:

- changes in utilisation of ICT tools are much slower than the appearance of new tools and solutions,
- the smartphone keeps its place as the key element of the actual utilisation.

Considering the limitations of data collection, further investigation is required that includes both the expansion of the research sample and deploying quantitative analysis for understanding personal motivations.

Karcsics (2007) detected three main development strategies based on the maturity of employee competencies:

- catching up (entry-level),
- compliance with current competitive situation,
- providing skills to ensure long-term competitive advantage.

I believe that nowadays entry-level tasks can be limited to the content and usage of specific corporate systems in case of the students belonging to Generation Y. On the one hand ICT background is granted and achievable, on the other hand the changes of related attitudes has begun. There is a need for improving compliance with the current competitive situation in order to achieve a harmonic development between education and labour market expectations. The focus must be on teaching how to exploit the ICT possibilities during problem solving. Case studies, homework assignments and targeted projects can foster the progress.

In addition, diffusion of smartphones is a warning sign to higher education institutions. Smartphones may give the way to reach the students and to arouse their interest in course materials and other relevant information. General and targeted information flow is channelled: Facebook, Twitter and mobile-conforming webpages are important but not enough. The content of education must be adapted in the interest of two main challenges:

- it allows the effective utilisation of the ICT tools held by the students,
- it motivates the ICT users to identify with the learning objectives.

REFERENCES

COUPLAND, D. (1991). Generation X: Tales from an Accelerated Culture. New York: St. Martin's Press.

KARCSICS, É. (2007). A versenyképes munkavállaló kompetenciái az Európai Unióban és Magyarországon. (Competences of Competitive Employees in the European Union and in Hungary). Európai Tükör, 12(3), 128-140.

KENDALL, M. G. (1970). Rank correlation methods. London: Griffin.

KINDLER, J. & PAPP, O. (1978). Komplex rendszerek vizsgálata: Összemérési módszerek. (Investigating Complex Systems: Comparison Methods). Budapest: Műszaki Könyvkiadó.

KSH (2014). Infokommunikációs (IKT-) eszközök és használatuk a háztartási, a vállalati (üzleti) és a közigazgatási szektorban, 2013. (Information and Communication (ICT) tools and their use in household, corporate (business) and the public sector, 2013). Retrieved: September 2015: http://www.ksh.hu/docs/hun/xftp/idoszaki/ikt/ikt13.pdf.

KSH (2015). Távközlés, internet, 2014. IV. negyedév. (Telecommunications, Internet, 4th quarter 2014). Statisztikai Tükör, 2015/21, 1-3.

KSH (2016). Távközlés, internet, televíziószolgáltatás, 2016. III. negyedév. (Telecommunications, Internet, TV services, 3rd quarter 2016). Statisztikai Tükör, 9. December 2016, 1-6.

PAIS, E. R. (2013). Alapvetések a Z generáció tudománykommunikációjához. (Foundations for the science communication of Generation Z). Project report. Pécs: University of Pécs.

RAPCSÁK, T. (2007). Többszempontú döntési problémák. (Multi-attribute decision problems). Budapest: Budapesti Corvinus Egyetem.

SAATY, T. L. (1980). The Analytic Hierarchy Process. New York: McGraw Hill.

SASVÁRI, P. L. (2012a). Az információs rendszerek kisvállalati alkalmazásának vizsgálata, magyar- és horvátországi összehasonlító elemzés. (The penetration of information systems in small and medium-sized enterprises in Croatia and Hungary: A comparative study). Vezetéstudomány, 43 (Special Issue), 56-65.

SASVÁRI, P. L. (2012b). The Impact of Information Technology on Business Productivity: Revealing the Link between Company Size Categories and the Proliferation of Business Information Systems in Hungary. Saarbrücken: LAP Lambert Academic Publishing.

SASVÁRI, P., & WOLF, R. (2014). Austria and Hungary: Different stages of readiness to create added value by using business information systems. PRO PUBLICO BONO – Public Administration, 3, 169-178.

STRAUSS, W., & HOWE, N. (1991). Generations: The History of America's Future, 1584 to 2069. New York: William Morrow.

SZLÁVICZ, Á. & SZRETYKÓ, G. (2013). Az Y generáció munkával kapcsolatos elvárásai és a cégek EEMrendszereinek új kihívásai. (New work expectations of Generation Y and new chalenges for corporate EEM systems). Tér–Gazdaság–Ember, 1(1), 69-84.

TÖRŐCSIK, M. (ed.) (2015). A Z generáció magatartása és kommunikációja. (Behaviour and communication of Generation Z). Pécs: University of Pécs.