Ksenija Dumicic, Toni Milun, and Josipa Antic. 2019. Adult Participation in Lifelong Learning for Better Employability in Selected European Countries. *UTMS Journal of Economics* 10 (1): 41–55.

Original scientific paper
(accepted April 2, 2019)

ADULT PARTICIPATION IN LIFELONG LEARNING FOR BETTER EMPLOYABILITY IN SELECTED EUROPEAN COUNTRIES

Ksenija Dumicic[1]
Toni Milun
Josipa Antic

Abstract
Regardless Adult participation in learning (APinL) indicator was by European Commission (2010) in Europe 2020 Strategy targeted with 15% by 2020, for European Union (EU) countries the respective percentage in 2017 was 10.9% only, with coefficient of variation of 70.4%. Recently it has been increasing for majority of European countries, being still quite low in many of them. In 2017 the lowest values was in Romania, 1.1%, and the highest in Sweden, 30%, in some highly developed economies, APinL was below the EU-28 average, e.g. in Germany 8.5%, and in some countries, like Croatia, decrease rate for APinL in 2017 related to 2006 was -19.4%, from 3.1% to 2.5%. Applying data exploration, trend, correlation, regression and cluster analysis, this paper investigates economic, social and digital society development indicators influencing APinL in selected European countries in 2017. It was positively correlated with Gross Domestic Product per capita, employment rate, percentage of those high educated, having the strongest positive correlation with Digital skills. It showed weak negative correlations with middle and low education level indicators. Two valid regression models enlightening impacts on APinL were developed. Finally, four clusters of similar European countries were created, occasionally included the countries that joined them surprisingly.

Keywords: skill gap, digital skills, education level, regression analysis, cluster analysis.

Jel Classification: C2; C38; I25; E24

[1] **Ksenija Dumicic**, PhD, Full Professor, University of Zagreb, Croatia; **Toni Milun**, MSc. Math., Univ. Spec. Oec., Algebra University College, Zagreb, Croatia; **Josipa Antic**, MSc. Math., Univ. Spec. Oec., De Pauli AG, Garching bei München, Germany.

INTRODUCTION

In the lifelong learning, defined as percentage of persons aged 25 to 64 who recently received education or training, people have the goal to learn, with the focus on learning activity, formal, non-formal or informal, started with the goal of improving particular knowledge, skills and competences. Since the year 2016, the variable Lifelong learning (LLL) got a new name, Adult participation in learning (APinL), Eurostat (2018).

Data analysed in this paper, originate from the EU Labour Force Survey, where the APinL refers to persons aged 25 to 64 who received training or education during four weeks preceding the survey (numerator). The denominator is comprised of the total population, excluding those persons within the same age group who did not answer to participation in education and training questions. All education or training information, regardless the relation to the respondent's employment status, have been collected.

The authors found the motivation for this study in the previous research described in Dumicic and Milun (2018), where only statistical education of employed Croats was analysed. This paper presents the logical continuation of the research on the variable APinL in general, in 33 European countries in the recent period of 2002 to 2017. In this paper, authors want to test the research hypothesis that the Gross Domestic Product per capita (GDPpc), the employment rate, as well as the high educational level and digital society development indicators, all have positive impact on the APinL. For this purpose, the influence of selected six variables on the APinL was explored using statistical data exploration, linear regression and cluster analysis methods. The six included explanatory variables, for 2017, have been as follows:

- Two economic development indicators: Gross Domestic Product per capita in Purchasing Power Standards (PPS), Index EU-27=100; and Employment rate, as a percentage in total, age group 20–64 years;
- Three variables for Participation rate in education and training, as a percentage in total, of persons from 15 to 64 years with: less than primary, primary and lower secondary education (levels 0–2); upper secondary and post-secondary non-tertiary education (levels 3–4); and tertiary education (levels 5–8); and, finally
- One digital skills development indicator defined as the Individuals who have basic or above basic overall digital skills, as a percentage of all individuals aged 16–74.

Nowadays, in a digital society, the workforce should use its digital society benefits to improve the skill shortage noticed at the labour market request. People of different age may use the lifelong learning opportunities for improving their reading, writing, literacy and numeracy skills, as well as for improving communication skills and language. All this may improve workforce employability and make them more mobile.

After the introductory definitions of basic research variables and setting of the research hypothesis, in this paper, the literature review and descriptive data exploration with trend modelling of the main variable studied follow. Further, regression and cluster analysis, giving better insight into the research problem, have led to the conclusions, with regard to the limitations of the analysis.

1. AN OVERVIEW OF CURRENT RESEARCH

Recent lifelong learning researches in Europe, based on the regression analysis are conducted by Hudokova, Schultzova, and Rabatinova (2014), Tikkanen, and Nissinen (2016) and Martinez-Cerda, and Torrent-Sellens (2016). In the paper by Hudokova, Schultzova, and Rabatinova (2014) an increasing trend of adult participation in formal and non-formal education and vocational training in the Slovak Republic was noticed. The paper justified that the unemployed people want to participate in lifelong learning to increase their employability. Tikkanen, and Nissinen (2016) studied participation in lifelong learning linked to job among employees who were well educated in selected Nordic countries, using "Nordic model" of lifelong learning as a benchmark. Among adult populations, for those younger and with lower education, the model appeared to be more appropriate, and it was less valid for adults who are highly educated. Martinez-Cerda, and Torrent-Sellens (2016), using the Eurostat's Adult Education Survey (AES) data for Spain in 2011, concluded that during the economic crisis, formal online learning could be a good solution to overwhelm the difficulties in job finding. Therefore, the authors proposed that the e-learning has to be reconsidered for lifelong learning educational programmes.

Lifelong learning in Europe by many authors was already explored. Green (2011) compared different models of the "knowledge economy" and the "knowledge society" and analyzed their relationship with systems of lifelong learning within national and regional models. Based on the large-scale European Commission study that is searching for enlightening the impact of current reforms in the adult learning policy application in Europe, the paper by Broek, and Buiskool (2012), compares mobilisation strategies for lifelong learning in European countries. Zarifis (2012) analysed adult participation in education in three countries, Bulgaria, Cyprus and Greece, and concluded that cultural, structural and socio-economic aspects have more influence on participation in adult learning than policy problems. In paper by Beblavy, Thum, and Potjagailo (2014), it was found that participation in adult's education increases across the age over all the cohorts and cross-country differences were identified. In Scandinavian countries, adult learning is independent from formal education. Whereas, in central European countries, adult learning is mostly part of growing educational achievement. In some countries, e.g. Ireland and the UK, a modification of two attitudes to adult learning is recognized.

Clain (2016) discusses the economic importance of lifelong learning in recovering from economic crisis, assuming that participation of individuals in lifelong learning activities can stimulate the economic growth of EU countries, by decreasing unemployment rates, increasing earnings and employability and overall economic competitiveness.

The 10 articles within the book edited by Koulaouzides and Popovic (2017), offer critical view of education systems and lifelong learning experiences in the region of eight Southeastern European countries. Authors express the worry that contemporary adult education policy development and lifelong learning is experiencing an autonomy loss imposed by the dominant neoliberal economic paradigm.

The article by Marcinkiewicz-Wilk, and Jurczyk-Romanowska (2018) emphasizes the idea of lifelong learning as an important EU strategy, with the main goal of building

the Information Society. In Castano Munoz et al. (2013) offers planning the future of adult learning in Europe up to 2030. Stawiak-Ososinska (2018) explored the challenges facing adult education in contemporary Europe. It was found that unemployed and the inactive people, those less qualified and skilled, older people and immigrants or ethnic minorities are less likely to participate in lifelong learning and additional training.

Modern ways of affordable learning are mostly related to the Internet usage, hence the paper by Dumicic and Zmuk (2019) forecasted the Internet practice in the World Regions. The EU-28, as the region, stays as the world leader in digital economy with 80% individuals using the Internet in 2015, 82% forecasted value (true value was 81%) for 2017 and 87% forecasted value for 2020. The World, as the whole, has had lower results with 44% in 2015 and forecasts 49% for 2017 and 58% in 2020.

The paper by Pavaloaia et al. (2019) focuses the public sector employees' digital maturity and attitude towards the lifelong learning in Romania, as a part of Education for Sustainable Development (ESD).

Dumicic (2013) explored Adult participation in learning (APinL), in the EU-27 and six more countries from 2006 to 2011 by different multivariate methods. Estimated regression models showed that the APinL depends on earnings, and on levels of education, primary and tertiary, which positively influence the employment rate. In Dumicic, and Zmuk (2017) the web survey of Croatian enterprises showed that the lack of statistical methods application, and so that a lot of respective potential remained idle. In Dumicic (2017) the enhancing of statistical literacy, defined by Gal (2002) as the capacity to critically communicate, interpret and evaluate statistical information, as "a unique language for a better world", was considered as an important skill for active citizenship. The author concluded that the APinL provides a great chance for any type of skills and knowledge improvement needed for better employability and workforce mobility.

The series of national reports on Survey on skill shortages and gaps in European enterprises, see Cedefop (2015b), are offered online for each of the EU-28 countries, Iceland and Norway. E.g., for Croatia it is given as Agency for Vocational Education and Training and Adult Education 2018, Guidance and Outreach for Inactive and Unemployed – Croatia. In Cedefop (2015a), based on the Cedefop's European skills and jobs survey, where qualifications related to jobs in the EU are analysed with the goal of finding between them a perfect fit.

In European Commission (2013), The Survey of Adult Skills that "measures of literacy, numeracy and problem solving in technology-rich environments" with the elaborated implications for education and training policies in Europe was done in 40 countries within the PIAAC and the results are given in OECD (2016). One of the findings of the Survey is that 2/5 of the workforce population in the EU has low literacy and numeracy skills, education. Those highly skilled are participating in adult learning, and those lowly skilled are less likely to use any learning activities.

According to OECD (2016), only 55% of the EU adults with literacy skills at level 1 or below are employed, nearly 10% are unemployed and 1/3 are inactive. In European Commission (2018), the effect of technological progress on EU and national policies is elaborated. It emphasizes the importance of new skills agenda and developing of the key competences for lifelong learning and digital skills. European Commission (2019)

reports on recent employment and social developments in Europe, showing quarterly tendencies by sectors and population groups. In the third quarter Q32018, compared to the Q32017, the employment rate grew at a similar speed for both genders, while slightly less for women.

2. DATA AND METHODS

Using the Eurostat data, the descriptive data exploration and trend modelling were conducted for the main variable under study APinL. Afterwards, in revealing the significant impacts on APinL, the Ordinary Least Squares (OLS) regression analysis was performed. At the end, the cluster analysis was applied to recognize the countries of each of the noticeable clusters. The influence of six variables on the APinL was examined. All variables are listed in Table 1.

Table 1. Definitions of variables included into analysis with official data sources

Type	Notation	Definition	Data source in Eurostat
Dependent	Y_{APinL}	Adult participation in learning, total, % of population aged 25 to 64 years.	Eurostat (2018b).
Independent	X_{GDPpc}	Gross Domestic Product per capita in Purchasing Power Standards (PPS), Index EU-27=100	Eurostat (2018c).
Independent	X_{EMPLOY_RATE}	Employment rate, % in total, age group 20-64 years.	Eurostat (2008d).
Independent	X_{EDUC_L0-2}	Participation rate in education and training, % of all persons from 15 to 64 years with less than, primary, primary and lower secondary education (levels 0-2)	
Independent	X_{EDUC_L3-4}	Participation rate in education and training, % of all persons from 15 to 64 years with upper secondary and post-secondary non-tertiary education (levels 3-4)	Eurostat (2018f).
Independent	X_{EDUC_L5-8}	Participation rate in education and training, % of all persons from 15 to 64 years with tertiary education (levels 5-8)	
Independent	$X_{DIGSKILLS}$	Individuals who have basic or above basic overall digital skills by sex, % of all individuals aged 16-74	Eurostat (2018e).

3. EXPLORATORY DATA ANALYSIS

Table 2 includes data for the APinL for 2006 and 2017, with ranks related to 2017. All the EU-28 countries plus Iceland, Norway and Switzerland and North Macedonia (before 2018, the country was named in Eurostat as The Former Yugoslav Republic of Macedonia) and Turkey, are included into analysis. Since other EU candidate countries did not offer all the data, they were not included.

Table 2. Adult participation in learning*, in 2006 and 2017 for 33 European countries

Rank by 2017	Country Code	APinL_2006	APinL_2017 (sorted descending)	Rate of change 2017/2006 (%)
1	CH	22.5	31.2	38.7
2	SE	18.8	30.0	59.6
3	DK	29.2	27.3	-6.5
4	FI	23.1	27.2	17.7
5	IS	27.9	24.4	-12.5
6	NO	19.1	20.2	5.8
7	NL	15.9	18.8	18.2
8	FR	6.4	18.6	190.6
9	LU	8.3	16.8	102.4
10	EE	6.5	16.3	150.8
11	AT	13.2	15.5	17.4
12	UK	27.4	14.3	-47.8
13	SI	15.2	11.6	-23.7
14	ES	10.7	9.8	-8.4
15	PT	4.2	9.8	133.3
16	CZ	5.8	9.6	65.5
17	MT	5.5	9.4	70.9
18	DE	7.5	8.5	13.3
19	IT	6.1	8.2	34.4
20	BE	7.8	7.9	1.3
21	LV	7.3	7.5	2.7
22	CY	7.4	6.8	-8.1
23	HU	4.0	6.3	57.5
24	IE	7.4	6.1	-17.6
25	LT	5.0	5.9	18.0
26	TR	2.0	5.7	185.0
27	EL	2.1	4.5	114.3
28	PL	4.7	3.8	-19.1
29	SK	4.3	3.2	-25.6
30	HR	3.1	2.5	-19.4
31	MK	2.3	2.4	4.3
32	BG	1.6	2.3	43.8
33	RO	1.5	1.1	-26.7

Source: Adult participation in learning, Eurostat (2018b)

**Note*: "The indicator measures the share of people aged 25 to 64 who stated that they received formal or non-formal education and training in the four weeks preceding the survey (numerator). The denominator consists of the total population of the same age group, excluding those who did not answer to the question 'participation in education and training'. Adult learning covers formal and non-formal learning activities — both general and vocational — undertaken by adults after leaving initial education and training. Data stem from the EU Labour Force Survey (EU-LFS) ".

Figure 1 shows the comparison of percentages for the APinL (total) in 33 European countries with the EU-28 average in 2006 and 2017, data sorted by 2017, and indicating different dynamics in 2017/2006 over countries. In 2017, the leaders in APin L indicator were highly developed countries, Switzerland (31.2%) and Sweden (30%), as opposed to transition countries at the bottom: Croatia (2.5%), North Macedonia (2.4%), Bulgaria (2.3%) and Romania (1.15%), three of them belonging to the EU-28.

Figure 1 shows that many highly developed countries with the highest values for the APinL percentage are above the EU-28 average, but it also shows a surprising fact that several highly developed countries, e.g. Ireland (IE), Germany (DE), Belgium (BE), are below the EU-28 average.

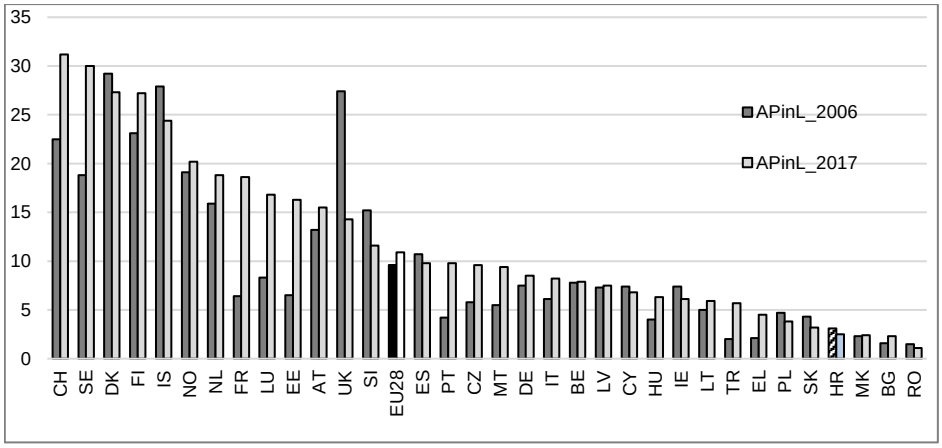

Figure 1. Adult participation in learning (%, total) in n=33 European countries and the EU-28 in 2006 and 2017 (sorted descending by 2017)

Source: Table for Adult participation in learning, Eurostat (2018b)

Figure 2 shows slightly increasing linear trend for the APinL in EU-28 and decreasing trend for Croatia (HR) for the period from 2002 to 2017. A short-term forecast, based on the linear trend extrapolation, only for 2018 was calculated.

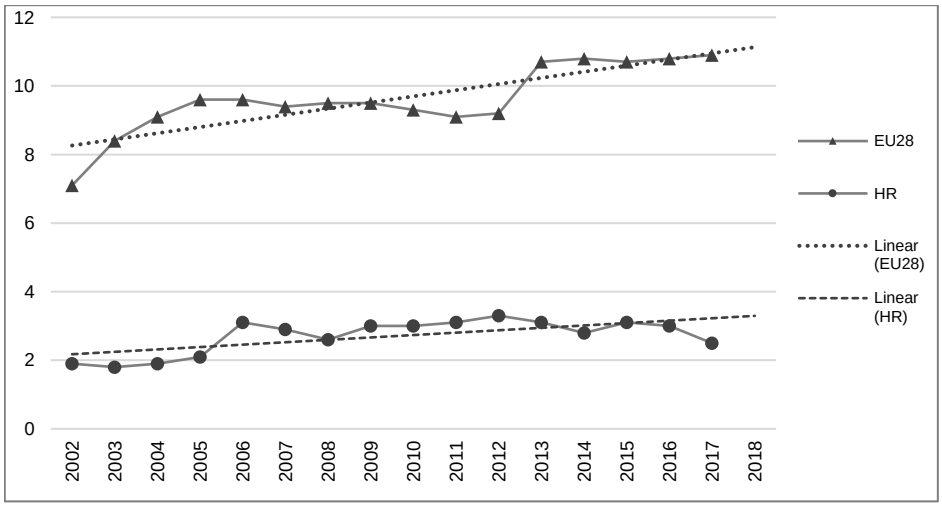

Figure 2. Adult participation in learning (percentage, Total) trend in EU-28 and Croatia for the period 2002 to 2017 and the forecast for 2018

Source: Eurostat (2018b)

For the EU-28, the best-fitted model has been the simple OLS linear trend model, Figure 2 and Equation 1, for the line showing a positive slope:

$$Y_{APinLTrend(EU-28)} = 8.08 + 0.18x;\ R^2 = 0.7054. \quad (1)$$

For Croatia, the OLS estimated quadratic trend (increasing/ decreasing) was the best fitted, Figure 2, with the Equation 2:

$$Y_{APinLTrend(HR)} = 2.17 + 0.25x - 0.01x^2;\ R^2 = 0.4989. \quad (2)$$

Regarding Croatia, the trend line is slowly decreasing, forecasting in this manner quite worse perspective for the Croatian APinL indicator (Equation 2, Figure 2).

Even though the authors wanted to analyse all seven variables for all 33 countries in 2017, it was not possible because of the lack of data for the variables of interest.

When performing the descriptive statistics analysis, the variable GDPpc in PPS, Index EU-27=100, has shown a strong outlier for Luxembourg (z=3.41). After it was excluded from the analysis, the descriptive statistics were calculated again. Table 3 gives data for all variables in 2017 for 27 countries only. After the new mean for 27 countries was calculated (94.11 PPS), Ireland data for GDPpc in PPS appeared to be an outlier, with z=3.1, given in Table 3, but it was accepted being not too serious, so, the Ireland data remained for the further study.

Table 3. Descriptive statistics for selected 27 EU-28 countries, 2017 (without LU)

Descriptive Statistics	Y_{APinL}	X_{GDPpc}	X_{EMPLOY_RATE}	X_{EDUC_L0-2}	X_{EDUC_L3-4}	X_{EDUC_L5-8}	$X_{DIGSKILLS}$
Mean	11.08	94.11	72.49	24.19	47.28	28.53	55.81
Standard error	1.51	5.61	1.08	2.01	2.09	1.39	2.51
Median	8.90	89.00	73.30	21.10	45.20	29.70	55.00
Mode	2.30	77.00	73.40	21.10	41.20	#N/D	50.00
Std. deviation	7.85	29.15	5.59	10.46	10.88	7.20	13.04
Kurtosis	0.61	1.92	0.67	1.52	-0.51	-1.16	-0.14
Skewness	1.11	1.08	-0.79	1.41	-0.22	-0.21	-0.12
Range	29.30	135.00	24.00	39.70	41.60	24.30	50.00
Minimum	1.10	49.00	57.80	12.00	24.90	15.30	29.00
Maximum	30.40	184.00	81.80	51.70	66.50	39.60	79.00
Count	27	27	27	27	27	27	27
Coeff. of var. CV=	70.85%	30.98%	7.71%	43.27%	23.01%	25.24%	23.36%
Zmin, country	-1.3 Romania	-1.5 Bulgaria	-2.6 Greece	-1.2 Lithuania	-2.1 Spain	-1.8 Romania	-2.1 Bulgaria
Zmax, country	2.5 Sweden	3.1 Ireland	1.7 Sweden	2.6 Portugal	1.8 Czechia	1.5 Ireland	1.8 Netherlands
Outlier, country	-	Ireland	-	-	-	-	

Source: Eurostat (2018b, 2018c, 2018d, 2018e, 2018f)

Exploratory data analysis shows that all the variables have moderately strong to quite strong data dispersion, with CV between 7.71% for employment rate, with skewness of -0.79, up to 70.85% for Adult participation in learning distribution, with a skewness of 1.11.

4. REGRESSION MODELS BUILDING

4.1. Correlations

The correlations between the variables are given in the correlation matrix, Figure 3.

	Y_{APinL}	X_{GDPpc}	X_{EMPLOY_RATE}	X_{EDUC_L0-2}	X_{EDUC_L3-4}	X_{EDUC_L5-8}	$X_{DIGSKILLS}$
Y_{APinL}	1.0000						
X_{GDPpc}	**0.5404**	1.0000					
X_{EMPLOY_RATE}	**0.5462**	0.3615	1.0000				
$X_{EDUC\ L0-2}$	-0.0137	0.0443	-0.3966	1.0000			
$X_{EDUC\ L3-4}$	-0.3346	-0.3871	0.1387	-0.7721	1.0000		
$X_{EDUC\ L5-8}$	**0.5242**	0.5193	0.3650	-0.2875	-0.3867	1.0000	
$X_{DIGSKILLS}$	**0.8032**	0.5961	0.6192	-0.1348	-0.2160	0.5209	1.0000

Figure 3. Correlation matrix for n=27 countries of EU-28 (without Luxembourg) for 2017.

According to Figure 3, the variable Y_{APinL} is positively correlated with the Gross Domestic Product per capita in Purchasing Power Standards, here denoted as X_{GDPpc} (r=0.5404), with the employment rate, denoted as X_{EMPLOY_RATE} (r=0.5462), with the Participation rate in education and training, % of persons with tertiary education (levels 5-8) X_{EDUC_L5-8} (r=0.5242) and with Individuals who have basic or above basic overall digital skills, denoted as $X_{DIGSKILLS}$ (r=0.8032). The remaining two variables, X_{EDUC_L0-2} and X_{EDUC_L3-4}, have a very weak negative correlation with Y_{APinL}, and therefore these variables are not included in further regression modelling.

4.2. Regression models

Two OLS linear regression models were developed and tested for diagnostics. Since the Luxembourg (LU) data for X_{GPDpc} appeared to be a serious outlier, only 27 EU countries were included in the linear regression models for 2017. Two regression models, both without any model assumptions violation, were developed: Model 1 (with K=2 regressors, for n=27 EU countries in 2017. The dependent variable is Y_{APinL}, and the independent variables are the Gross Domestic Product per capita in Purchasing Power Standards and the employment rate); and Model 2 (with K=1 regressor, for n=27 EU countries in 2017. The dependent variable is Y_{APinL} and the independent variable is Individuals who have basic or above basic overall digital skills, $X_{DIGSKILLS}$).

The estimated models are given in expressions (3) and (4), respectively, as follows:

- Model 1:

$$\hat{Y}_{APinL} = -40.02 + 0.11 \cdot X_{GDPpc} + 0.57 \cdot X_{EMPL\_RATE}, \quad (3)$$
$$R^2 = 0.4337, R = 0.6586, n = 27, F = 9.19, \hat{\sigma} = 6.15, CV = 55{,}51\%.$$

The variable X_{GDPpc} influences Y_{APinL} in a statistically significant way at 5% sig. level (t=2.395, p-value=0.024). For every unit increase in X_{GDPpc}, having the X_{EMPL_RATE} unchanged, the regression value of the Y_{APinL} will increase by 0.11 percentage points. The variable X_{EMPL_RATE} influences Y_{APinL} in a statistically significant way at 5% sig. level (t=2.450, p-value=0.022), too. For every unit increase in X_{EMPL_RATE}, having the X_{GDPpc} unchanged, the regression value of the Y_{APinL} will increase by 0.57 percentage points. The regression coefficient of determination R^2 shows that the model explains 43.37% of total variation. Regression coefficient of variation equals 55.51%, indicating moderately good representativeness of the Model 1.

- Model 2:

$$\hat{Y}_{APinL} = -15.91 + 0.48 \cdot X_{DIGSKILLS}, \quad (4)$$
$$R^2 = 0.6452, R = 0.8032, n = 27, F = 45.46, \hat{\sigma} = 4.77, CV = 43.05\%.$$

The variable $X_{DIGSKILLS}$ influences Y_{APinL} in a statistically significant way at 1% significance level (t=6.74, p-value=4.57E-07). For every unit increase in $X_{DIGSKILLS}$, the regression value of the Y_{APinL} will increase by 0.48 percentage points. Regression coefficient of determination R^2 shows that the model explains 64.52% of total variation. Regression coefficient of variation equals 43.05%, indicating moderately good representativeness of the estimated regression Model 2.

For both cross-sectional models, the regression diagnostics shows the models' validity. The White's test for heteroskedasticity shows that there is no problem of heteroskedasticity at 1% significance level. Chi-square test for normality of residuals shows that there is no problem of non-normality at 5% significance level. Since for Model 1, the Variance Inflation Factor equals VIF<5, the multicollinearity problem does not exist.

5. HIERARCHICAL CLUSTERING OF COUNTRIES

Using n=28 countries data, for EU-28 without outlying data for Luxembourg and Ireland plus North Macedonia and Turkey, for APinL and GDPpc in 2017, the dendrogram based on Ward Linkage and Squared Euclidean Distance was developed, Figure 4.

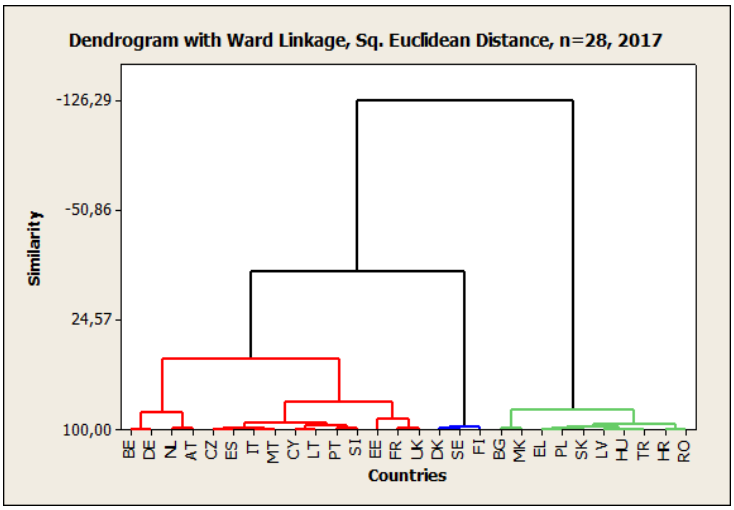

Figure 4. The dendrogram, based on APinL and GDPpc for n=28 countries (EU-28 without LU and IE, and with the EU candidates MK and TR)

Source: Eurostat (2018b), Eurostat (2018c)

The clusters in Figure 4 suggest that 10 middle to low-developed transition countries and/or EU candidates and those South-East European countries gather in the cluster of their own: Bulgaria, North Macedonia, Greece, Poland, Slovakia, Latvia, Hungary, Turkey, Croatia and Romania. Three highly developed countries, Sweden, Finland and Denmark, with the highest level of ICT and digital performances are in their cluster, too. The third cluster is devoted to 15 countries that are quite developed, but are in the middle regarding the joint influence of APinL and GDPpc variables: Belgium, Germany, Netherlands, Austria, Czechia, Spain, Italy, Malta, Cyprus, Lithuania, Portugal, Slovenia, Estonia, France and United Kingdom.

6. INTERNET USE FOR INCREASING ADULT PARTICIPATION IN LEARNING

In Figure 5, an additional graphical analysis was performed regarding some potentials for increasing the APinL in the digital era for all countries and especially for those who appeared to be weak in Adult participation in lifelong learning.

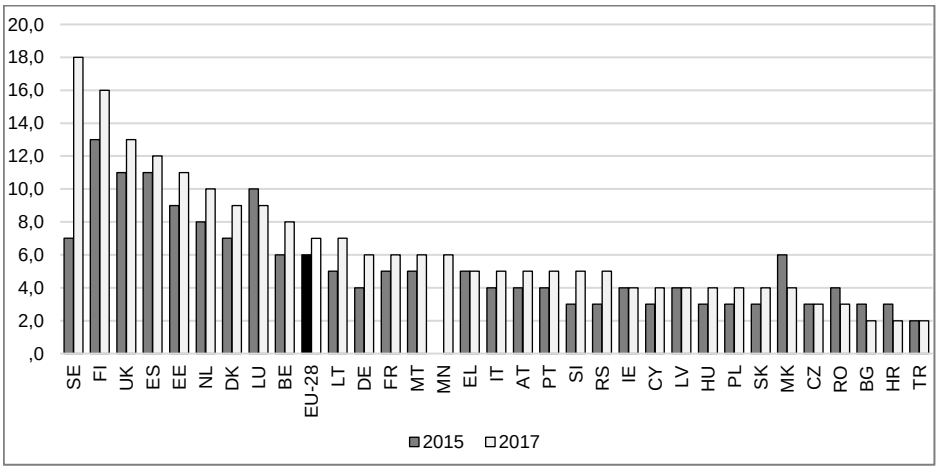

Figure 5. Internet use: doing an online course (of any subject), percentage of individuals aged 16 to 74, for 33 European countries and the EU-28, for 2015 and 2017 (data ranked by 2017)

Source: Eurostat (2018e)

It might be seen in Figure 5, that in 2017 the same countries were positioned at the top and the same at the bottom when ranked according to APinL and according to Internet use for doing online course variables. Scandinavian countries, led by Sweden were ranked highly, at the top, and Bulgaria and Romania have been at the bottom for both variables.

CONCLUSIONS

For each country the goal should be to improve both work force's skills to fit the employers' needs and to increase employment level, as well as employment adequacy. Research results may influence the education policy makers to concentrate on digital skills education programs and opportunities primarily.

In the recent period, from 2006 to 2017, the APinL percentage shows an increase in majority of European countries, being for the EU-28 at 9.6% in 2006 and 10.9% in 2017.

The most impressive increase in APinL of 190.6%, from 6.4% in 2006 to 18.6% in 2017, for France was noticed. In the same period, the most surprising decrease of -47.8% appeared for highly developed United Kingdom.

Croatia has decreased from very low 3.1% in 2006 to even lower 2.5% in 2017, with the declining rate of change of -19.4%, but still having Bulgaria and Romania ranked below. In 2006, Croatia was at the sixth position from the bottom, better than Greece, which increased its APinL from 2.1% in 2006 to 4.5% in 2017, at a noticeable increase rate of 114.3%, becoming in 2017 better positioned than Croatia.

Among EU candidates, Turkey increased APinL from 2% in 2006 to 5.7% in 2017, with an increase rate of 185%, which seems encouraging, while North Macedonia increased APinL from 2.3% in 2006 to 2.4% in 2017, with a modest increase rate of 2.4%.

For the EU-28, the best-fitted trend model for the APinL percentage has been the linear trend model, showing an increasing tendency, with the yearly slope of 0.179 percentage points. What might worry is the tendency for the respective indicator for Croatia, with estimated quadratic increasing/decreasing trend as the best fitted. Croatian trend line is going down, forecasting a very bad perspective for the Croatian APinL percentage, probably because of great economic emigration rate, which erases individuals who might be the best candidates for the lifelong learning from the country.

Data exploration statistics for selected European countries in 2017 reveals that the main variable under study is very dispersed over countries, with coefficient of variation of above 70%, and data range of 29.3 percentage points, from 30.4% for Sweden and 1.1% for Romania, highly positively skewed, with skewness of 1.11.

The research hypothesis tells that the Gross Domestic Product per capita (GDPpc) (Pearson r=0.5404), the employment rate X_{EMPLOY_RATE} (r=0.5462), the education indicator for highest-education level, $X_{EDUC\_L5\text{-}8}$ (r=0.5242), as well as the digital society indicator, $X_{DIGSKILLS}$ (r=0.8032), have positive correlation with the APinL percentage in the observed European countries. The results of regression analysis confirmed positive influence of Gross Domestic Product per capita, employment rate and digital society indicator on the APinL percentage. The strongest correlation of APinL with Digital skills is important, suggesting further actions of education policy makers, those who create education programs, educators who offer education and even employers, who may support such programs for lifelong learning to help work force to reach better employability by minimizing the skill gap towards the work demand.

When using the GDPpc and the APinL jointly, the most developed and the richest European countries were clustered and those less developed gathered in their own cluster, as well. However, some countries, like Croatia and Romania, are shown to be

very specific, since very high economic emigration rates decreased the number of people who would be the candidates for improving the APinL. Sweden, Finland and Denmark, with the highest level of ICT and digital performances are in their own cluster, having very high APinL and high GDPpc, as well.

The internet use for attending the courses online shows a great potential for an increase of the APinL percentage at a low cost, which might be especially important for countries that are at the lower economic development level.

The authors are motivated for further investigations of the APinL, as the means to bridge the skill gap of workers' supply and workers' demand, in European countries. Using possibilities of lifelong learning, people from the workforce enable better professional and digital skills, as well as other skills. In such a way, the workforce improves its mobility and achieves better employability. This may motivate the education economy and education programs policy makers to do additional efforts to improve opportunities for developing permanent programs for additional education of those employed and unemployed, especially related to improving their digital skills. Since this research was focused on European countries only, their complete relative position might be evident if the World regions would serve for comparison. In the future research, additional variables, such as governments' expenditure for education; employers' attitudes and efforts towards additional education for their workers; educators' offer of education programs for adults; as well as economic migration; the gender and the age groups dimensions; might be included. This would enable clarification and better understanding of the role of Adult participation in learning, as the potential for better employability in each country.

REFERENCES

Agency for Vocational Education and Training and Adult Education. 2016. *Vocational education and training in Europe: Croatia.* Cedefop ReferNet VET in Europe reports. http://libserver.cedefop.europa.eu/vetelib/2016/2016_CR_HR.pdf (accessed September 11, 2018).

Beblavy, Miroslav, Anna-Elisabeth Thum, and Galina Potjagailo. 2014. Learning at every age? Life cycle dynamics of adult education in Europe. *Studies in Continuing Education* 36 (3): 358–379.

Broek, Simon, and Bert-Jan Buiskool. 2012. Mapping and comparing mobilisation strategies throughout Europe: Towards making lifelong learning a reality. *Journal of Adult and Continuing Education* 18 (1): 4–26.

Castano Munoz, Jonatan, Christine Redecker, Riina Vuorikari, and Yves Punie. 2013. Open Education 2030: Planning the future of adult learning in Europe. *Open Learning* 28 (3): 171–186.

Cedefop. 2015a. Skills, qualifications and jobs in the EU: the making of a perfect match? Evidence from Cedefop's European skills and jobs survey. *Cedefop reference series* 103. Luxembourg: Publications Office. http://dx.doi.org/10.2801/606129 (accessed September 2, 2018).

———. 2015b. Skill shortages and gaps in European enterprises: Striking a balance between vocational education and training and the labour market. *Cedefop reference series* 102. Luxembourg: Publications Office. http://dx.doi.org/10.2801/042499 (accessed September 2, 2018).

Clain, Alexandru. 2016. Lifelong learning: A solution for recovering from the economic crisis? In *Proceeding of the Third Academos Conference 2016, Governing for the future: Interdisciplinary Perspectives for a Sustainable World*, June 9–12, 2016, Bucharest (Romania), Medimond Publishing Company.

Dumicic, Ksenija, and Berislav Zmuk. 2017. Enhancing statistical culture: The unused potential of Croatian enterprises. In *Selected papers from the 2016 Conference of European Statistics Stakeholders, Special issue*, ed. E. Baldacci et al., 61–71. Luxembourg: Publications Office of the European Union.

http://ec.europa.eu/eurostat/documents/3888793/8435601/KS-TC-17-006-EN-N.pdf/68310461-0930-4c1d-b935-dfdcd9f36f53 (accessed September 1, 2018).

Dumicic, Ksenija, and Berislav Zmuk. 2018. Lifelong learning development level in selected European countries: A perspective for improving statistical literacy. In *e-Proceedings of Challenges and Innovations in Statistics Education Multiplier Conference of ProCivicStat, Szeged, Hungary, September 07–09, 2017*, ed. Peter Kovacs, 1–6. Szeged: University of Szeged, Faculty of Economics and Business Administration. http://www.eco.u-szeged.hu/english/research/scientific-publications/challenges-and-innovations-in-statistics-education?folderID=42798&objectParentFolderID=42798 (accessed January 6, 2018).

———. 2019. Forecasting of the Internet Usage in the World Regions. In *Creative Business and Social Innovations for a Sustainable Future: Advances in Science, Technology & Innovation. IEREK Interdisciplinary Series for Sustainable Development*, ed. Miroslav Mateev and Panikkos Poutziouris, 155–165. Cham: Springer.

Dumicic, Ksenija, and Toni Milun. 2018. Adult Learning as a Chance for Improving Statistical Literacy of Decision Makers: Focusing the Case of Croatia. In *Proceedings of the Tenth International Conference on Teaching Statistics*: *Looking back, looking forward, ICOTS10, 8–13 July 2018, Kyoto, Japan*, ed. M. A. Sorto, A. White, and L. Guyot. Voorburg, Netherlands: International Statistical Institute. http://iase-web.org/Conference_Proceedings.php?p=ICOTS_10_2018 (accessed October 27, 2018).

Dumicic, Ksenija. 2013. Multivariate Analysis of Life-long Learning in European Countries. In *Proceedings of the ISI_59th World Statistics Congress (WSC), Hong Kong, 25–30, August 2013*. http://www.statistics.gov.hk/wsc/CPS205-P3-S.pdf (accessed September 10, 2018).

———. 2017. Enhancing Statistical Literacy as a Unique Language for a Better World. Plenary Speech. In *Book of Abstracts ICOS2017: The International Conference on Official Statistics, Sarajevo, B&H, 30.–31.03.2017*, ed. E. Kremic and K. Kozaric, 19–21. Sarajevo: School of Economics and Business in Sarajevo, University of Sarajevo.

European Association for the Education of Adults (EAEA). 2017. *EAEA Infonote: Upskilling Pathways: New Opportunities for Adults.* http://mellearn.hu/wp-content/uploads/2017/02/Upskilling-pathways-infonote_final.pdf (accessed October 17, 2018).

European Centre for the Development of Vocational Training. 2018. *Cedefop Skills Panorama*. http://skillspanorama.cedefop.europa.eu/en/skillstheme/matching-skills-and-jobs (accessed December 1, 2018).

European Commission. 2010. *Europe 2020: A European strategy for smart, sustainable and inclusive growth*. Communication from the Commission, European Commission, Brussels.

———. 2013. *The Survey of Adult Skills (PIAAC): Implications for education and training policies in Europe.* http://www.oecd.org/skills/piaac/PIAAC%20EU%20Analysis%2008%2010%202013%20-%20WEB%20version.pdf (accessed October 17, 2018).

———. 2014. *Adult Participation in Lifelong Learning: The impact of using a 12-months or 4-weeks reference period.* http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92330/lbna26918enn.pdf (accessed October 17, 2018).

———. 2018. *Employment and Social Developments in Europe Annual Review 2018.* http://ec.europa.eu/social/BlobServlet?docId=19719&langId=en (accessed December 29, 2018).

———. 2019. *Employment and Social Developments in Europe ESDE*. *Quartely Review*, March 2019. https://ec.europa.eu/social/BlobServlet?docId=20863&langId=en (accessed March 27, 2019).

Eurostat. 2018a. *Adult learning statistics.* http://ec.europa.eu/eurostat/statistics-explained/index.php/Adult_learning_statistics (accessed January 17, 2019).

———. 2018b. *Adult participation in learning by sex.* https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=sdg_04_60&plugin=1 (accessed January 27, 2019).

Eurostat. 2018c. *Gross Domestic Product per capita in Purchasing Power Standards.* https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tec00114.

———. 2018d. *Employment rate by sex, age group 20–64.* https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_10 (accessed January 27, 2019).

———. 2018e. *Individuals who have basic or above basic overall digital skills by sex.* https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tepsr_sp410 (accessed January 27, 2019).

———. 2018f. *Population by educational attainment level, sex and age (%): Main indicators.* http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_lfse_03&lang=en (accessed January 27, 2019).

Gal, Iddo. 2002. Adults' Statistical Literacy: Meanings, Components, Responsibilities. *International Statistical Review* 70 (1): 1–5.

Green, Andy. 2011. Models of Lifelong Learning and the 'Knowledge Society' in Europe. *Papers-Revista de Sociologia* 96 (4): 1075–1096.

Hudokova, Kristina, Anna Schultzova, and Marcela Rabatinova. 2014. Selected Determinants of Lifelong Learning of Population in the Slovak Republic, ed. Oleg Deev, Veronika Kajurova, and Jan Krajicek. *European financial systems* 2014: 258–265.

Koulaouzides, George A., and Katarina Popovic, eds. 2017. Adult Education and Lifelong Learning in Southeastern Europe: A Critical View of Policy and Practice. *Book Series: International Issues in Adult Education* 24: 1–134.

Marcinkiewicz-Wilk, Aleksandra, and Ewa Jurczyk-Romanowska. 2018. Development and Implementation of Ideas of Lifelong Learning in Europe at the Dawn of the 21st Century. *Journal of Education Culture and Society* 9 (1): 39–49.

Martinez-Cerda, Juan-Francisco, and Joan Torrent-Sellens. 2016. Effects of E-Learning about Having a Work Contract. In *Proceeding Edulearn16: 8th International Conference on Education and New Learning Technologies*, ed. L.G. Chova, A.L. Martinez, and I.C. Torres, 1268–1277.

OECD. 2016. *Skills Matter: Further Results from the Survey of Adult Skills.* Paris: OECD Skills Studies; OECD Publishing. https://doi.org/10.1787/9789264258051-en (accessed January 27, 2019).

Pavaloaia, Vasile-Daniel, Mircea Radu Georgescu, Daniela Popescul, and Laura-Diana Radu. 2019. ESD for Public Administration: An Essential Challenge for Inventing the Future of Our Society. *Sustainability* 11 (3): 880. doi: 10.3390/su11030880.

Stawiak-Ososinska, Malgorzata. 2018. Challenges facing adult education in contemporary Europe. In *Proceedings of Fifth International Conference on Adult Education (Ciea 2018): Education for Values; Continuity and Context*, 293–299.

Tikkanen, Tarja, and Kari Nissinen. 2016. Participation in job-related lifelong learning among well-educated employees in the Nordic countries. *International Journal of Lifelong Education* 35 (3): 216–234.

Zarifis, George. 2012. Adult participation in education in Southeastern Europe: An elaboration on the study report for the assessment of the impact of ongoing reforms in education and training on the adult learning sector. *Journal of Adult and Continuing Education* Volume 18 (1): 27–42.