

ASSESSMENT OF E-GOVERNMENT IN EU COUNTRIES

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Abstract: *E-government is one of the priority trends of public administration modernization in the EU countries (28). The paper deals with the evaluation of the e-government state, because of the importance of e-government as a tool of progressive modernization of public administration. The presented research is specifically focused on the comparison of the current state of e-government in the European Union and the assessment of the position of the Czech Republic on the basis of e-government indicators. The attention is paid to e-government indicators monitored by international institutions (United Nations, European Union and Eurostat) using TOPSIS method. Evaluated data describe the state of e-government in EU countries in the year 2013. In the research, there was selected the final list of variants (monitored EU countries) and criteria (e-government indicators - User Centric Government, Transparent Government, Citizen Mobility, Business Mobility, Key Enablers, Online Service Index, E-Participation Index, Individuals Using Internet and Enterprises Using Internet). The results of the evaluation of the EU countries in terms of the state of e-government by TOPSIS method in the 2013 acknowledged, that the best ranking in this field obtained Estonia, then the Scandinavian countries (Finland, Sweden) and Malta. The worst state of e-government was reported in Romania, Bulgaria and Croatia. The Czech Republic then in the evaluation of e-government occupied the 24th position across all EU countries (28).*

Keywords: *Assessment, E-government, EU Countries, Public Administration, TOPSIS.*

JEL Classification: *H11, H83.*

Introduction

E-government belongs to important current trends of modernization efforts of public administration [19, 28] and it is also the subject of various international comparisons, as discussed by [2] or [5]. Interpretation of the term “e-government” is quite broad and divergent. The general definition describes e-government as the use of information and communication technologies (ICT) in a way of government transformation for the purpose of increasing availability, effectiveness and accountability. According to United Nations (UN) [29] e-government is the use of ICT and its application by the government for the provision of information and public services to the people. On the other hand the European Union (EU) defines e-government as the use of ICT in public administration combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies. The importance of e-government in the context of the modernization of public administration is dealt also by domestic authors such [16, 17 and 24]. E-government here does not simply represent the direction of public administration modernization, but it is also discussed as a tool for modernizing public administration. Also [29, 22] highlight the role of e-government to provide significant opportunities to transform public administration into an instrument of sustainable development.

The aim of this paper is to compare the current state of e-government in accordance to the theoretical and empirical approach in the EU based on indicators of e-government.

The evaluation is focused on indicators monitored by international institutions (UN, EU and Eurostat) using TOPSIS method. The state of e-government is evaluated in the EU (28) including assessment of the position of the Czech Republic (CR) in the year 2013. This stated objective is supported by the research question whether are in average the results of e-government state in the original EU countries (EU-15) better then results of e-government state in the EU countries accessing the EU in 2004 (EU-10).

The structure of the article is devoted into introduction and theoretical statement, where attention is paid to the importance of information and communication policy and e-government as one of the important tools to the development of the information society. The results of empirical research then evaluate e-government in EU countries and in the CR by usage of TOPSIS method. Unlike other studies, the evaluation of e-government is performed not only for individual EU countries (EU-28) but also for the average of different groups of EU countries (average of EU-28, EU-15, EU-10 and EU-25).

1 Statement of a problem

When talking about computerization of public administration in the international dimension, there has been steadily working with the designation “e-government”, as stated in [24]. The involving of ICT in public administration activities is the standard part of the of public administration modernization nowadays both in developing and transition countries. A significant role is attributed primarily to Internet access to general public. In [28] is highlighted especially the role of web-based technologies to deliver the government services. There are many advantages to promote new technologies in public e-services. They are in opposite to traditional structures non-hierarchical, two-way, and available 24 hours a day, seven days a week. This character of Internet delivery helps citizens to seek information in more comfortable way, not just when a government office is open [32]. The interactivity of the Internet is also expected to improve government accountability as it makes government more responsive to the needs and demands of citizens. In the EU, the e-government has also high priority in the modernization of public administration. E-government is one of the measures that are aimed to take advantage of information and communication technologies across Europe [27]. In times of considerably limited public resources ICT can help the public sector to find innovative ways of services delivery to citizens while increasing efficiency and reducing costs [6, 7].

1.1 E-government as a part of the European Information Policy

Fundamentals of the political decision to invest in e-government services have been established in the Lisbon Strategy, which was approved by EU member states in the year 2000. Contemporary concept of e-governance in the EU is based on the original eEurope initiative, which has been promoted in the EU since 1999 [23, 24].

E-government is in the European Information Policy considered as one of the tools for building an information society. Prospectively, it is assumed here the certain standardization of supply range of electronic public services and the way of services providing, which should ensure interconnectivity of some e-government solutions across EU member states. In this connection there is spoken about “Pan-European e-services”, as shown in [13, 24]. In 2002 was introduced continuing eEurope 2005 initiative, where e-government also played significant role. Currently is the essential European strategic framework for e-government development called “Digital Agenda for Europe”. This

document was adopted in the year 2010 and it is one part of the Europa 2020 initiative. This strategy primarily highlights the current variability of the e-government services provision across the EU, the lack of cross-border coverage and low utilization by citizens. To the promotion of e-government and its enforcement in practice across EU member states there are created so called “Action plans”. These documents contain specific measures and recommendations for the successful implementation of specified measures. The current action plan is called „The European eGovernment Action Plan 2011-2015“ and it was adopted in 2010, see [12]. The European Commission has specified here the objectives of the “Digital Agenda” strategy in the field of e-government. The main tasks and objectives of the “Action Plan”, as stated in [21], have been defined in cooperation with professional and scientific community dealing with research and development of e-government services. They are in line with European trends, concretely:

- Services designed based on users' needs.
- Common creation of public services and public administration (the principle of WEB 2.0).
- Re-use of public sector information.
- Strengthening of public administration transparency and participation of public in decision-making processes.
- Development of so called “Cross-border public services” and the simplification of citizen's and entrepreneur's mobility.
- General streamlining of organizational processes in public administration.

These selected targets show that the political priority of the EU is the increase of accessibility of public administration services to citizens and the private sector which can be regarded as a positive development. Another important trend of contemporary European e-government is the development of e-participation. This is the introduction of innovative electronic tools that enable basically anyone to involve actively in decision-making processes of government.

1.2 Approaches to the evaluation of e-government at the supranational level

E-government has been monitored as a part of the activities of many organizations. Approaches to e-government monitoring differ considerably across organizations, for example Eurostat [14] processes and evaluates data in the field of e-government by indicators measuring the interaction of citizens and businesses with public administration. The OECD has been involved in monitoring of the usage of ICT in EU member countries, see [21] or [7], but e-government as a specific area is not measured here. OECD also deals with economic analysis of e-government, see [22], focusing on identification of the e-government impacts in terms of costs and benefits comparison. In contrary European Commission's approach to e-government evaluation is connected with the effectiveness evaluation of European Information Policy [9]. This activity is based on the obligations of the European institutions. For the purpose of European Information Policy evaluation, there was designed the evaluation framework of basic e-services by the organization Capgemini [4]. These services are evaluated annually in the EU. The evaluation of selected aspects of e-government is at the international level also dealt with benchmarking of UN. There is evaluated the practice and progress of UN member countries in e-government. UN [30] deal with the evaluation of e-government on the basis

of the annual evaluation of “eGovernment Readiness index” and “E-participation index”. In contrast, on the distinction of different levels of “overall maturity scores” of e-services is based the evaluation of the organization Accenture from 2000, see [1].

However, e-government data of international organizations and other institutions are not consistent with each other, as they have been monitoring different time periods using different methodologies of data collecting and data processing. They have been also focusing on description of different sub-areas of e-government services according to the specific needs and purpose of the organizations. The paper focuses therefor on the synthesis of these approaches. In this way is possible to achieve the comprehensive information on the state of e-government in the EU countries. The bases to the e-government evaluation are the e-government indicators monitored by Eurostat, UN and European Commission, see [9], [14], [30].

2 Methods

The method used in the comparison is TOPSIS method (The Technique for Order Preference by Similarity to Ideal Solution). It is one of the methods of multi-criteria evaluation of alternatives. According to [26] the aim of the methods of multi-criteria evaluation of alternatives is to determine the ranking of individual variants in terms of selected criteria, wherein the variant with the best ranking represents the best compromise variant. Methods for the selection of compromise variant under no dominant variants differ in approach to the definition of what is "compromise variant" and further according to complexity and usability for different types of multi-criteria problems. The results obtained by various methods are therefore subjective and may differ. These methods can be divided according to the type of information required. TOPSIS method is based on the selection of variant that is closest to the ideal variant and furthest from baseline variant. It is assumed the maximizing character of criteria. According to Bhutia and Phipon, see [3], TOPSIS is the simple concept enabling determination of the best variant through the mathematical calculation. Application of TOPSIS method is as follows [33]:

- Creation of normalized decision matrix R according to (1):

$$r_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^m y_{ij}^2}}, \quad (1)$$

where r_{ij} are elements of matrix R ; $i = 1, 2, \dots, m$; $j = 1, 2, \dots, r$; y_{ij} are the original input data for variant i and criterion j ; m is the number of variants.

- Calculation of weighted decision matrix W by (2):

$$w_{ij} = v_j * r_{ij}, \quad (2)$$

where w_{ij} is weight normalized value and v_j is weight of criterion.

- Determination of the ideal variant H_j and basal variant D_j relative to the matrix values W , see (3) and (4):

$$H_j = \max(w_{ij}), \quad (3)$$

$$D_j = \min(w_{ij}), \quad (4)$$

for $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, r$.

- Distance calculation of variants from the ideal variant, respectively basal variant, see (5) and (6):

$$d_i^+ = \sqrt{\sum_{j=1}^r (w_{ij} - H_j)^2}, \quad (5)$$

$$d_i^- = \sqrt{\sum_{j=1}^r (w_{ij} - D_j)^2}, \quad (6)$$

for all $i = 1, 2, \dots, m$; and $j = 1, 2, \dots, r$.

- Calculation of the relative distance indicator of variants from basal variant by (7):

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-}, \quad (7)$$

where $i = 1, 2, \dots, m$.

- Arrangement of variants by non-growing values of c_i .

Based on the results of TOPSIS method was possible to determine ranking of EU countries in terms of the functioning of e-government and to verify the position of the CR in the international comparison in the year 2013. In the research there was selected the final list of variants (the EU-28 countries) and criteria (9 e-government indicators.) The selected e-government indicators ($i_1 - i_9$) included:

- User Centric Government (i_1) - shows the extent to which the service is provided online and how is delivery perceived by the user.
- Transparent Government (i_2) - shows the extent to which governments are transparent in terms of: their own responsibilities and performance, process of service delivery and personal data.
- Citizen Mobility (i_3) - indicates the extent to which EU citizens can use online services in another country.
- Business Mobility (i_4) - indicates the extent to which businesses can use online services in another country.
- Key Enablers (i_5) - indicates to what extent are available on-line technical requirements: eID, e-Documents, authentic sources, eSafe and SSO.
- Online Service Index (i_6) - describes the range and quality of online services.
- E-Participation Index (i_7) - monitors on-line services and information provided to citizens by governments, interaction among stakeholders and involvement of citizens in decision-making process.
- Individuals Using Internet (i_8) - describes the percentage of individuals using Internet in relation to public administration.
- Enterprises Using Internet (i_9) - describes the percentage of enterprises using Internet in relation to public administration.

The research is based on data set across multiple data sources. These are “eGovernment Benchmark” study from 2014, see [9], data processed by Eurostat, see [14] and data managed by UN, see [30]. Evaluated data describe the state of e-government in the year 2013. In the first step there were inserted the input data into the decision matrix Y , where each element y_{ij} according to [20] requires the value of i -th variant and of the j -th criteria, see in Tab. 1.

Tab. 1: Input data for 28 variants and 9 criteria - decision matrix Y

Country	i_1	i_2	i_3	i_4	i_5	i_6	i_7	i_8	i_9
Austria	82	68	35	59	82	0.62745	0.74803	92	54
Belgium	72	51	37	44	58	0.62745	0.67716	89	50
Bulgaria	60	38	24	52	23	0.25480	0.23622	83	23
Cyprus	60	36	48	75	46	0.31372	0.47244	85	30
CR	57	29	33	48	25	0.25490	0.37007	94	29
Germany	65	30	29	66	49	0.70588	0.66929	83	49
Denmark	80	59	47	67	72	0.54901	0.66141	95	85
Estonia	84	75	79	70	87	0.76470	0.77165	95	48
Greece	50	23	16	18	11	0.80392	0.60629	84	36
Spain	87	66	12	59	77	0.78431	0.94488	82	44
Finland	83	63	81	76	60	0.70588	0.77165	97	69
France	75	64	38	31	69	0.96078	1.00000	96	60
Croatia	54	40	31	38	7	0.33333	0.46456	93	25
Hungary	45	23	13	27	30	0.45098	0.55905	84	37
Ireland	84	48	68	76	18	0.64705	0.67716	95	45
Italy	75	49	30	37	42	0.78431	0.74803	85	21
Latvia	73	67	26	57	63	0.64705	0.75590	99	34
Luxembourg	62	36	39	68	41	0.54901	0.62204	90	56
Lithuania	73	61	65	54	74	0.70588	0.70078	93	35
Malta	94	96	87	89	95	0.47058	0.40157	88	32
Netherlands	81	51	42	76	36	1.00000	0.92913	90	79
Poland	72	37	23	40	62	0.49019	0.54330	90	23
Portugal	90	71	32	73	83	0.64705	0.63779	92	38
Romania	45	17	20	17	12	0.47058	0.44094	65	5
Sweden	81	59	64	61	64	0.60784	0.70078	95	78
Slovenia	70	53	48	36	46	0.39215	0.42519	93	52
Slovakia	44	17	22	54	8	0.62745	0.48818	92	33
United Kingdom	70	38	49	85	27	0.96078	0.89763	91	41

Source: Authors according to [9], [14], [30].

All criteria are maximizing nature (the higher the value, the better the rating). In calculations using TOPSIS there are considered also the weights of individual criteria. The weights of individual criteria were determined by scoring method. All the criteria were the same weight as all criteria are equally relevant to the assessment of the state of e-government. The calculations were processed in SANNA software, see [18].

3 Problem solving

The above mentioned input data were processed using TOPSIS method. Evaluation of the state of e-government in the EU was based on values assessment within the set of criteria for e-government evaluation in each country, which was based on the synthesis of e-government evaluation approaches of major international organizations. E-government was evaluated based on the e-government indicators ($i_1 - i_9$) describing the on-line services of governments, transparency of governments, possibility to use the on-line service abroad by citizens and enterprises, technical enablers, quality of online services on governmental

webpages, participation of citizens, utilization of Internet by individuals and enterprises when communicating with public authorities.

The results indicate the state of e-government in the EU countries (28). It's shown here the e-government state of individual EU countries compared with the EU (28) average. There are compared the averages of country groups EU-28, EU-25, EU-15 and EU-10. The research is aimed also to evaluation of the e-government state in the CR in international context and there are pointed out the shortcomings and possible solutions of the situation.

3.1 Evaluation of e-government in the EU countries using the TOPSIS method

On the basis of TOPSIS method there was performed distance calculation from ideal and basal variant. Distance coefficient of variant i from the ideal variant d_i^+ was calculated from (5). Distance coefficient of variant i from basal variant d_i^- was calculated according to (6). Subsequently there was calculated the relative distance indicator c_i . The relative distance of variant i from the basal variant is given by (7). Values of individual variants are summarized in Tab. 2.

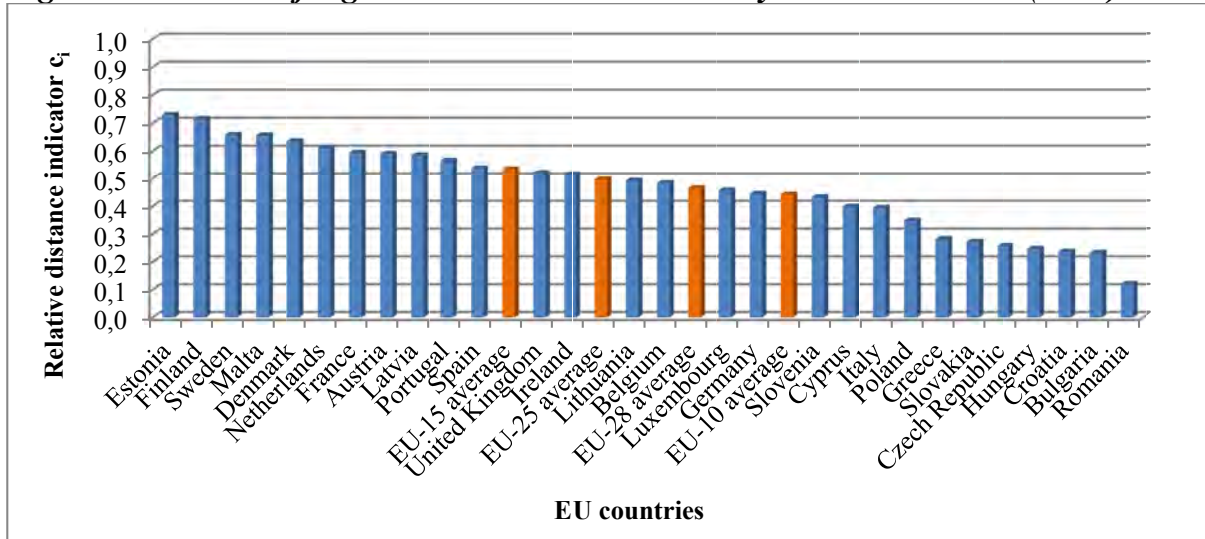
Tab. 2: Values of distance coefficients and of relative distance indicator

Country	d_i^+	d_i^-	c_i	Country	d_i^+	d_i^-	c_i
Austria	0.03755	0.05317	0.58607	Ireland	0.04574	0.04869	0.51562
Belgium	0.04600	0.04067	0.46923	Italy	0.05218	0.03769	0.41941
Bulgaria	0.06917	0.02068	0.23020	Latvia	0.04454	0.04591	0.50760
Cyprus	0.05405	0.03736	0.40871	Luxembourg	0.05080	0.03765	0.42562
CR	0.06683	0.02133	0.24195	Lithuania	0.03309	0.05389	0.61959
Germany	0.05197	0.03886	0.42785	Malta	0.03175	0.07397	0.69970
Denmark	0.03642	0.05266	0.59116	Netherlands	0.04065	0.05526	0.57616
Estonia	0.02037	0.06739	0.76787	Poland	0.05755	0.03262	0.36173
Greece	0.07189	0.02578	0.26392	Portugal	0.03855	0.05468	0.58648
Spain	0.04571	0.05464	0.54449	Romania	0.07772	0.01173	0.13110
Finland	0.02637	0.06221	0.70235	Sweden	0.03266	0.05420	0.62400
France	0.04007	0.05556	0.58097	Slovenia	0.05223	0.03532	0.40343
Croatia	0.06846	0.02001	0.22614	Slovakia	0.07041	0.02404	0.25453
Hungary	0.07086	0.01936	0.21456	Unit. Kingdom	0.04611	0.05168	0.52848

Source: Authors

The values of the calculated indicator c_i range between 1 and 0. Value 0 corresponds to the basal variant; value 1 corresponds to the ideal variant, as shown in e.g. [33]. Based on the result, it is possible to determine the order of the EU countries in terms of the e-government functioning, from the best to the worst, as shown in Fig. 1. In Fig. 1, there are presented also the averages of different EU country groups (EU-28, EU-25, EU-15 and EU-10 average). Assessment of the state of e-government in the EU countries in 2013 showed that on the best place ranked Estonia and the Nordic countries - Finland and Sweden, while the worst e-government state was detected in Croatia, Bulgaria and Romania.

Fig. 1: Evaluation of e-government state in the EU by TOPSIS method (2013)



Source: Authors

Based on the c_i values of EU averages of different country groups can be deduced the difference in e-government state between original EU-15 countries and the EU-10 countries of EU enlargement in 2004. The average value of c_i indicator in EU-15 countries reached 0.53, while the average value of c_i indicator in EU-10 countries reached 0.44 (17 % lower value). To complete the value of indicator c_i in EU-25 countries reached 0.50 and in EU-28 countries 0.46 (without Bulgaria, Romania and Croatia).

EU countries were based on the c_i values divided into 3 groups (clusters): Countries with above-average state of e-government, countries with average state of e-government and countries with below-average state of e-government, see Tab. 3.

Tab. 3: Clustering of EU countries according to the e-government state (2013)

Above-average countries	Average countries	Below-average countries
Austria, Denmark, Estonia, Finland, France, Latvia, Malta, Netherlands, Portugal, Sweden,	Belgium, Cyprus, Germany, Ireland, Italy, Lithuania, Luxembourg, Poland, Slovenia, Spain, United Kingdom	Bulgaria, Croatia, CR, Greece Hungary, Slovakia

Source: Authors

Hierarchical cluster analysis was performed in the software IBM SPSS using Ward's method. The CR is according to the results of cluster analysis included into the cluster containing the countries with the below-average state of e-government.

4 Discussion

Based on the use of methods of multi-criteria evaluation of alternatives there was done the evaluation of the current state of e-government in the EU-28 countries and the verification of the position of the CR in international comparison in the year 2013. Results of this own research dealing with evaluation of the e-government state reflect to a considerable extent the current results obtained on the basis of international benchmarking activities of major international institutions such as World Forum [25, pp. 510-516] or European Commission [9].

The summary evaluation of the level of e-government in the EU is carried out annually according to the DESI index (The Digital Economy and Society). DESI is a composite index. It aggregates a set of relevant indicators structured around 5 dimensions (Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services). The own evaluation of e-government by TOPSIS method in our research showed the similar results as results obtained by index DESI evaluation. According to “Digital Agenda Scoreboard” [8], Romania is placed on the 28. position, Bulgaria on the 27. position and Croatia on the 24. position across the EU countries (28). The CR ranks on the 17. position out of the EU (28) countries. The best results in the evaluation of e-government according to DESI obtained the Scandinavian countries (Denmark – 1. place, Sweden – 2. place and Finland – 3. place). Similar evaluation results were demonstrated also in our research. The results of the evaluation by TOPSIS showed that apart from Sweden and Finland are the best rated countries also Estonia and Malta. But when evaluated by DESI Estonia occupied the 7. place and Malta the 12. place in the EU (28).

The result of TOPSIS method can be also compared with the results of other multi-criteria decision making methods. For example the evaluation of the e-government state in EU for 2013 according to WSA method (Weighted Sum Approach) confirmed the ranking of TOPSIS method. On the best place ranked also Estonia, then Finland and Malta. Similar on the worst place ranked Romania. Other countries with the worst state of e-government were Greece, Bulgaria and Hungary. The CR ranked on the 22. position when using WSA method. So both methods TOPSIS and WSA gave very close result to each other.

As follows from the results of comparative studies of e-government in EU countries [10, 11] within the implementation of e-government priorities were defined several typologies of countries: Pioneers (Malta, Finland, Estonia); Silo-topplers (Austria, Denmark, Spain, Lithuania, Portugal); Steady performers (Belgium, France, Italy, Latvia, Poland, Sweden, Slovenia); Business oriented (Cyprus, Germany, Ireland, Luxembourg, Netherlands, United Kingdom); Castaways (Bulgaria, Croatia, CR, Greece, Hungary, Romania, Slovakia). The division of states into groups is in most cases confirmed by the results of our research by TOPSIS method. The countries in the group “Pioneers” are in our research the top rated states in the field of e-government. Conversely, countries with the worst results in our survey (Bulgaria, Croatia, Romania) are likewise included in the same cluster. The results of “e-Government Benchmark” study in EU countries (28) show that the Nordic countries and Estonia are characterized by high level of citizens’ internet skills and online availability of public services. Malta is achieving high level of online availability of public services, but lower-level of citizen’s internet skills. The lowest level of citizen’s internet skills and online availability of public services is achieved by Croatia. CR then in this assessment reaches medium online availability of public services and the relatively low level of citizen’s internet skills. Similar results were demonstrated by our research.

Conclusion

The results of the e-government evaluation in EU countries (28) by TOPSIS method in the 2013 acknowledged, that the best ranking in this area obtained Estonia, then Finland, Sweden and Malta. The worst state of e-government was reported in Romania, Bulgaria and Croatia. Based on comparison of relative distance indicator in EU countries is possible to conclude that in terms of the e-government state are reached on average significantly

better results in EU-15 countries than in EU-10 countries. The value of the relative distance indicator in the EU-10 countries is about 17 % lower than the value of this indicator in the EU-15 countries. This indicates the worse state of e-government in the countries EU-10 in contrast to countries EU-15. It is also possible to note the exceptional status of Estonia, which, though also belongs among the EU countries of the eastern enlargement in 2004, showed the best state of e-government across the whole EU-28.

One part of the research was also the evaluation of e-government state in the CR. Based on the evaluation results was found highly unsatisfactory position of the CR in the field of e-government. The CR ranked among the five worst countries in the EU-28, and thus belongs into cluster with below-average EU countries in terms of the e-government state. Same as other V4 countries (Slovakia, Hungary) except Poland, which is placed in the group of countries with the average level of e-government. As indicated in the latest surveys of e-government in the EU countries, see [6], V4 countries (particularly the CR, Slovakia and Hungary) are doing in the area of e-government alike. In comparison with other EU states digitization of public administration is not very successful here. According to experts, this can be explained by the similar culture, public administration or a common feature of the lack of coordination of state activities. However Poland is for the other V4 countries in some areas the example of good practices. Only Poland from the V4 countries has performed comparable results with Western and Nordic EU countries in this area, as stated by index DESI and was also confirmed by own research. In the CR the e-government activities focused primarily on building large systems in recent years, which became the basis for the functioning of e-government. The cause of the inadequacy of the e-government state in the CR is mainly lack of the basic concept and long-term lack of interest by the Czech government. In the country there are serious shortcomings, particularly on the side of public digital services providers [15, 31]. Changing the attitude of government officials in this area is therefore required. E-government is a useful tool for reducing the cost of public administration and it is also the benefit for the residents in the form of time savings. This area remains for the CR the main challenge to the future. The good example of e-government practice for the CR can be Estonia that is on the top of EU in the field of digital services. As a good practise can serve British “gov.uk server”, that is an integrated, user friendly portal to access to all the services of the public administration or the using of intelligent forms to citizen’s communication with the public administration, as is the case in Poland now.

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