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AKADÉMIAI KIADÓ

User adoption and value of e-government services (Citizen-centric empirical study from Hungary)

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ABSTRACT

This paper looks at the adoption of e-government technologies from a citizen-centric, value-based point-of-view. We analyse e-government technology adoption and value creation on a large, representative Hungarian sample, using the data of the Good State Public Administration Opinion Survey. The paper examines the near total spectrum of the Hungarian government-to-citizen administration service areas: 11 e-government services, with a special focus on personal income tax administration and the use of government issued documents. The technology acceptance model and an e-government-specific adaptation of the DeLone – McLean information system (IS) success model are used as the theoretic base. Factor analysis, traditional association metrics and statistical tests are used for the analysis. Results confirm the relevance of the technology adoption factors suggested by the mainstream IS literature, while citizen-level value creation – in the form of cost or time saved, satisfaction level raised – was less demonstrable. Increasing citizens' internet trust or improving facilitating infrastructural conditions, as well as a significant value proposition in terms of time savings and ease of use would help increasing e-government service adoption levels and value creation potential.

KEYWORDS

technology acceptance model, e-government technology adoption, information system value, e-government value, trust

JEL CLASSIFICATION INDICES

H11, O33

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1. INTRODUCTION

Information technology (IT) projects cannot create value without users actually using the created system in a purposeful and effective manner. This is also true for governmental information technology initiatives, where main users can be public servants and citizens alike. So, usage is a necessary, but not sufficient condition for IT success. Further, one of the ultimate measures of e-government success is value creation (Gil-García et al. 2018). Digitalization of public administration services is not a goal in itself, it needs to create a value for the government or citizens, or possibly both. Accordingly, in this paper, we look at e-government adoption from a citizen-centric, value-based point-of-view. If we want to know whether public money are spent well, we have to investigate whether citizens are actually using the implemented e-government solutions, under which circumstances they feel more attracted to the online channels and whether the choice of the online service is associated with higher level of perceived value and satisfaction. To deepen our understanding, this paper investigates patterns and factors of e-government service usage with data from a large representative Hungarian questionnaire-based data collection covering a wide range of government-to-citizen e-services.

On the one hand, Hungary has not been in the front line of e-government innovation's early adoption: on the E-Government Development Index ranking (UN 2021) Hungary fell from its 30th place in 2008 to the 52nd place by 2020. Looking at the transition economies in Europe we see that e-government adoption is a great challenge not only in the technological sense but also concerning the mentality of individuals (Szabó – Chiriac 2016). On the other hand, this geographic focus is especially interesting as the Hungarian government spent significant funds on the technological reform of public administration (see more in Nemeslaki 2018). This fact makes the questions even more relevant: Are public funds spent well on e-government services? Are citizens using the e-government services introduced? What are the factors behind citizen adoption of e-government technologies? Do citizens feel that e-government services create value for them? The last two questions are going to be in the spotlight of our investigations, in the following specific form:

1. Which factors – presented in the technology acceptance literature – are associated with informational or transactional electronic government service use in comparison to the traditional, offline forms of public service use concerning the complete range of G2C (government-to-citizen) public administration services in Hungary?
2. Which perceived value elements – presented in the information system (IS) success literature – are associated with informational or transactional electronic government service use in comparison to the traditional, offline forms of public service use concerning the complete range of G2C public administration services in Hungary?

The research explores 11 different Hungarian e-government services, focusing on the actual usage behaviour of citizens, its factors and user satisfaction. These 11 service areas represent the whole palette of currently available e-government services, including for example personal income tax administration, administration of government issued documents or administration of construction affairs (see full list in Table 2).

This broad scale of services covered, the national representativity of the data collection and the fact, that the questionnaire focused on actual usage and not just on the intent to use, make these results especially interesting from an empirical point of view. As a theoretic basis of the research model this paper uses the most common Technology Acceptance Models (TAM) and Unified

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Theory of Acceptance and Use of Technology (UTAUT) frameworks extended by the factors of trust (Hsu et al. 2015; Lin – Wu 2015; AlAwadhi 2019) and e-government-specific adaptation of the DeLone – McLean IS success model (Scott et al. 2009, 2016). I use factor analysis, traditional statistical association metrics and statistical tests for analysis because this rich evidence would give researchers a more complex view of the factors driving citizen to adoption and value creation of e-government services and provide directions for further development to the policymakers.

The paper is structured as follows. The next section provides an overview of the related theoretic concepts and previous empirical results. The subsequent section introduces the research model, data collection and analysis methods. It is followed by the presentation of results and discussion, while conclusions and limitations are discussed in the last section.

2. BACKGROUND

2.1. E-government technology adoption

One of the most utilized models of information technology innovation acceptance is the Technology Acceptance Model (TAM) (Davis 1989; Venkatesh – Davis 2000), see the bold elements in Figure 1. The essence of the model is rather simple: attitudes regarding use, intention to use, and actual use are defined by two variables: perceived usefulness of the system and its perceived ease of use. In the IT/IS literature, more than 100 empirical studies tested these simple relationships of the TAM. The role of perceived usefulness was supported in 74% of these studies, while the ease of use often proved to be a necessary, but not a sufficient condition of usage (Lee et al. 2003).

Regarding e-government innovation adoption, a considerable amount of empirical research papers utilized TAM (Mensah – Mi 2017), or its expanded versions (Dorasamy et al. 2010; Alryalat 2017). Carter – Belanger (2005) also built their research on a modified version of TAM, finding that three primary factors define citizens' intention to use e-government services: perceived ease of use, compatibility (congruency with and similarity to citizens' normal way of communication or transactions) and reliability (whether users judge the service to be reliable and safe, and trust it). Many also used TAM in the context of specific e-government innovations, like e-voting technology (Choi – Kim 2012; Nemeslaki et al. 2016) and found its explanatory power to be strong.

The original TAM was extended by many (e.g., by Venketsh et al. 2003) and the UTAUT model was created in an attempt to synthesize these improvements and create a unified model (see the underlined elements in Figure 1). Here, along with the original two independent TAM variables, the moderating effects of social influence and facilitating environmental and infrastructural conditions are also included in the model. In the last decade, the use of the UTAUT model became popular among the e-government researchers as well (e.g., Gupta et al. 2008; Powell et al. 2012). Among perceived usefulness and social influence, perceived behavioural control was also found to be a significant determinant of attitude towards e-government by Yap et al. (2019). Hung et al. (2006) used an extended TAM and UTAUT model to examine the factors influencing willingness to use a Taiwanese online tax system, and found that the following factors had a significant effect on user attitude: perceived usefulness, perceived ease of use, perceived risk, trust, compatibility, as well as external influence, interpersonal influence, self-efficacy and facilitating conditions. In a Malaysian study Taiwo et al. (2014) concluded that perceived usefulness, risk taking propensity, attitude towards computers and trust in the internet are significant factors of citizens' intention to use e-government services.

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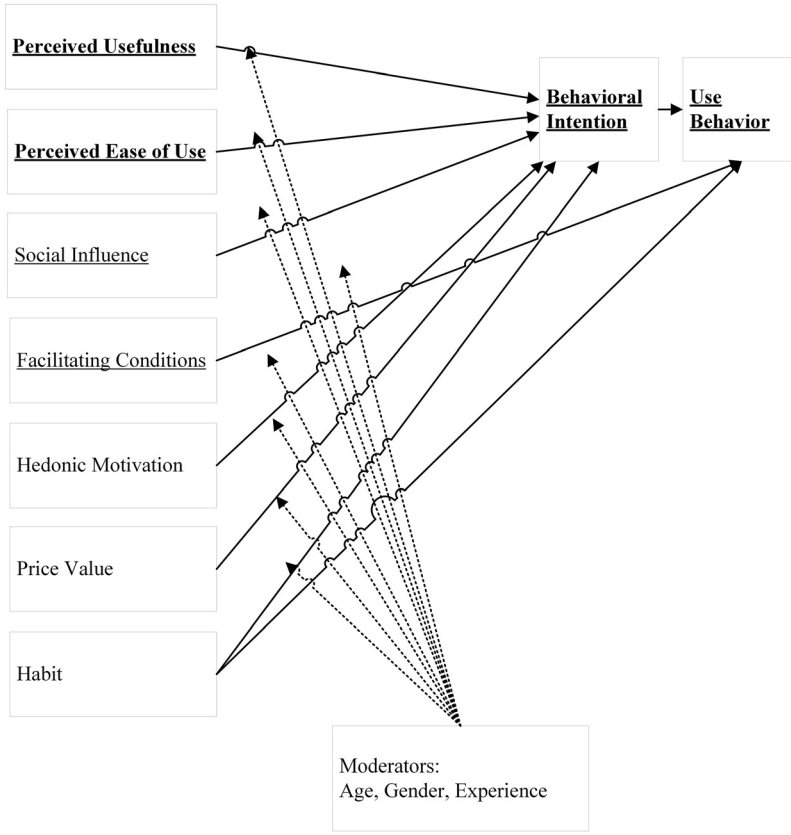


Fig. 1. Technology Acceptance Model
Note and sources: Elements in bold (Davis 1989); the expanded UTAUT model elements underlined (Venkatesh et al. 2003); UTAUT 2 the entire figure (Venkatesh et al. 2012).

Building on the popularity of UTAUT, Venkatesh et al. (2012) proposed a further extended version, UTAUT2 (Figure 1 illustrates the elements added in different developmental stages of the model). With three new constructs – hedonic motivation, price value and habit – the predictive power of their model increased significantly. E-government-specific synthesis models were also developed – for example Rana et al. (2017) who proposed a model including factors of performance and effort expectancy, social influence, facilitating conditions and anxiety, while the Dwivedi et al. (2017) tested a similar model factoring in perceived risk instead of anxiety.

Diffusion of Innovations (DOI) is also a widely used model in IT adoption and e-government research (Rogers 2003; Doresamy et al. 2010), but e-government researchers claim that its core constructs are similar to and substitutable by the TAM factors (Carter – Bélanger 2005; Colesca – Dobrica 2008). Rana et al. (2013) compared the explanatory power of the five most used IT adoption models in a meta-analysis based on 87 studies of citizen centric e-government services: TAM was the most widely used model in e-government adoption research, and also seemed to be the most appropriate one for studies that focus on citizens.

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2.2. E-government success and value creation from citizens' perspective

Regarding citizen-centric value creation, this paper also proposes to utilize a mainstream model from the IS literature: the DeLone – McLean (1992) IS success model. This model is one of the most cited research models that attempt to capture IT/IS success and value creation: according to Google Scholar, the original model is cited more than 14,500 times, 2,000 of which are in e-government related texts. The model also has some versions adapted specifically to the e-government context (e.g., Scott et al. 2009), see Figure 2. Although there are some wider concepts of e-government value creation and its different aspects (Bannister – Connolly 2014; Rose et al. 2015; Singh et al. 2017), this specific model is particularly useful for our research purposes for two reasons. First, because it describes a detailed concept of citizen-centric net benefit which can help us operationalize perceived value, second, because it connects the concepts of usage, user satisfactions and net benefit (from the citizens' perspective) in a single logical model.

3. SAMPLE AND METHOD

3.1. Data collection

The empirical basis of this research was provided by the Good State Public Administration Opinion Survey (henceforward referred to as GSS; Kaiser 2017) carried out in Hungary in February-March of 2017. The data collection was planned, tested and carried out by Szociometrum Social Science Research, a specialist professional institute. The survey questions were tested on a representative sample for the adult (age 18+) Hungarian population before the final data collection. The data collection was carried out in person with the help of interviewers and digital data recording. The sampling method was multistage, proportionally stratified probability sampling. In the first – geographic – stage 116 settlements of different size were chosen, while in the second stage the individual respondents were identified in a randomized manner. The database

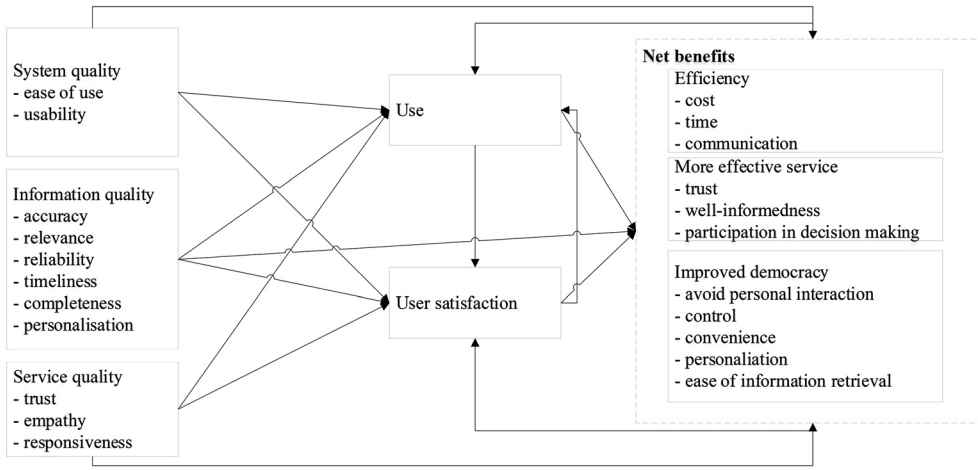


Fig. 2. E-government success in DeLone's model
Source: Scott et al. (2009: 7).

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was also corrected ex post with matrix weighting procedure concerning age, gender, region, settlement type and education (Demeter – Petényi 2017). See descriptive statistics in Table 1.

The GSS contained 70 questions, some with many sub-questions, all focusing on citizen-government relationship. This analysis only used some specific questions to explore factors of e-government service usage and value creation. The GSS provided the opportunity to use a large (n = 2,506) representative database, with data about citizens' usage and experience with the full spectrum of Hungary's 12 different G2C (government-to-citizens) areas of e-government services and the citizens general background as well. The full list of e-government services covered is the following:

1. Income tax administration
2. Tax administration at municipalities
3. Other tax administration at the national tax and customs administration agency
4. Administration of government issued documents
5. Family support administration
6. Health insurance administration
7. Unemployment administration
8. Social benefits administration
9. Pension insurance administration
10. Land registry administration
11. *Administration of construction permissions (omitted later)*[1]
12. Motor vehicle administration

Table 1. Descriptive statistics of the Good State Public Administration Opinion Survey sample

Gender	**N**	**%**	**Age**		
Female	1,352	54	Mean		46.51
Male	1,154	46	Median		45
Total	2,506	100	Range		19–89
Education			St. Dev		16.334
Maximum primary school	796	32	**Type of settlement**	**Frequency**	%
Secondary school	1,211	48	Capital (Budapest)	460	18
Bachelor's degree	399	16	Chief town of a county	539	22
Master's degree	99	4	Town	635	25
Postgraduate degree	2	0	Village	872	35
Total	2,506	100	Total	2,506	100

Source: Based on Demeter – Petényi (2017).

[1]"11) Administration of construction affairs" was omitted from further analysis due to its low subsample size – so in any further discussion - the analysis focuses on 11 service areas, only.

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Table 2. List of the analyzed government service areas and frequency of online usage

Government service areas	N	Frequency	
		Information online	Transaction online
1. Income tax administration	399	71 (19%)	101 (27%)
2. Tax administration at municipalities	238	18 (8%)	17 (7%)
3. Other tax administration at the national tax and customs administration agency	129	25 (21%)	22 (18%)
4. Administration of government issued documents	1,041	150 (16%)	59 (6%)
5. Family support administration	222	25 (12%)	15 (7%)
6. Health insurance administration	126	19 (16%)	13 (11%)
7. Unemployment administration	159	8 (5%)	6 (4%)
8. Social benefits administration	239	13 (6%)	5 (2%)
9. Pension insurance administration	97	11 (12%)	7 (7%)
10. Land registry administration	147	19 (14%)	13 (9%)
11. Administration of construction affairs (omitted)	*41*	*7 (18%)*	*9 (25%)*
12. Motor vehicle administration	395	73 (20%)	44 (11%)

Source: Aranyossy (2018: 7).

Concerning to the 11 administrative services citizens were asked whether they had to use these public services in the past three years, if yes, in what way they (1) gathered information (in person, via phone, via e-mail and/or via website) or (2) handled the necessary transaction (in person, via phone, online or via app and/or via post). Table 2 shows an overview of the number of respondents who declared to use these particular services as well as the frequency of citizens using these government services online for information gathering or transactional purposes. These last two columns of Table 2 represent the 22 cases of our analysis: the informational and transactional usage of the 11 government services.

3.2. Research model

The novelty of our approach lies in the following two characteristics. First and foremost, the analysis covers e-government users' perspective from technology adoption and value creation at the same time. While an earlier analysis of Aranyossy (2018) already explored some aspects of e-government service adoption in Hungary, this combination of the theories of technology adoption and value creation represents a new approach. Secondly, our focus on actual usage instead of intent to use in the TAM/UTAUT context is potentially more relevant for

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practitioners and policy makers, while still rare (although not without example e.g., Sivathanu 2018).

To test the different factors of e-government adoption Venkatesh et al.'s (2012) study served as a basis. This paper analyzed most of the factors and moderators included in UTAUT2 (presented in Figure 1) with the following content:

- Effort expectancy (perceived ease of navigation and use of the online channel);
- Facilitating conditions (availability of computers, laptops, smart phones and internet connection);
- Habit (previous habit of opting for online administration channels);
- Experience (experience with online tools like search engines, e-mail, social media, e-commerce, e-banking);
- Trust of internet (willingness to share personal data, register online);
- Trust of government (trust in the importance, necessity, efficiency and data security of government).

Notice that this model does not include one of the variables of TAM, perceived usefulness – instead, the study considered ex post usefulness, perceived value creation (see on the right side of Figure 3). The model also does not include price value and hedonic motivation, as by definition these concepts are less relevant in the e-government settings, and also, these factors did not have a real history in the e-government adoption research.

Trust related concepts are amongst the most common extensions of TAM in e-government research and their significance is shown in many studies (e.g., Powell et al. 2012; Taiwo et al. 2014; Alryalat 2017). Just like in many of the previous studies both trust in the internet and trust in the government are included in the research model.

Regarding the value creation aspect, our model includes all the net benefit elements from Scott et al. (2009) that our dataset allowed us to analyse. These are:

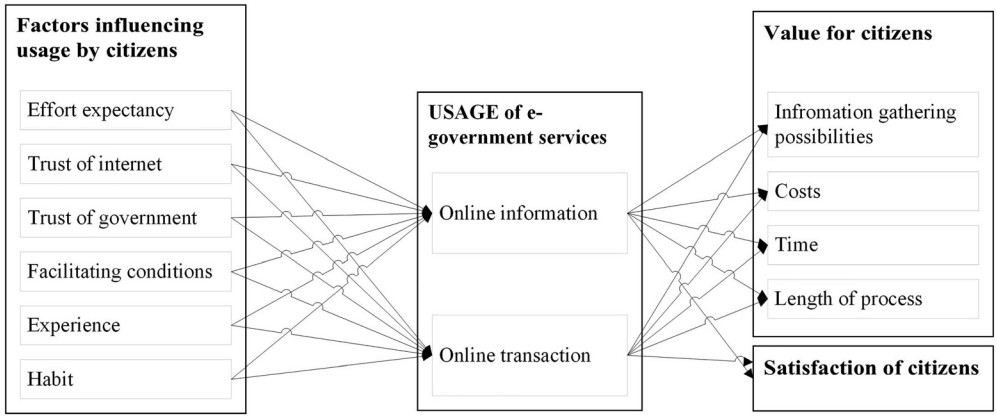


Fig. 3. Citizen-centric research model of e-government adoption, usage and value creation

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- Cost;
- Time (in two regards: time needed to administer and the length of the total administrative process);
- Ease of information retrieval;
- Total satisfaction.

While this study uses the verified constructs of UTAUT and Scott et al.'s (2009) citizens centric net benefit model, it extends the current literature by analysing these two aspects of adoption and value creation in a unified manner.

The database used is not only representative for the Hungarian citizens and covering the entire range of available e-government services, but also advantageous from another point of view: it allowed to test adoption factors of actual usage (not only the behavioural intention as traditional TAM research often does). This investigation can be more relevant from a practical and policy point of view, as it focuses more directly on the objective of e-government initiatives: actual usage by citizens. The dataset provided the opportunity to compare citizens using online and traditional channels in the information or the transaction phase of different public administration processes.

3.3. Analysis strategy

To gather information about the adoption factors, the perceived value and satisfaction components the respondents had to rate statements on a scale of 1–4. The even-point Likert scale is used to remove the middle, neutral option from the list. While in the case of satisfaction and value constructs direct measurement variables were used, in case of the six adoption constructs factor analysis was applied. (Although answers to the key construct questions were measured on a Likert scale, if a Likert scale is equidistant, it behaves more like an interval-level measurement and therefore, can be viewed as an interval scale and used for factor analysis (Carifio – Perla 2007).

The research was based on the constructs well defined and often measured in the literature, and the Hungarian Good State Survey questions were also pre-tested before the final data collection. To further test the construct validity and reliability, Kaiser – Meyer – Olkin (KMO) and Bartlett's tests were used. Based on the statistical tests factor loadings were mostly above 0.5 (with 3 exceptions out of 24 cases), KMO values were between 0.675 and 0.810 for the six measures, and the Bartlett-test was also affirmative.

The operationalization methods of the GSS data collection (the fact that some constructs were measured by one variable and/or a dichotomous variable) did not encourage the application of the regression or structural equation modelling common in the TAM literature. Also, this research had a wider aim than only to test already established TAM/UTAUT linkages, rather to put it into a wider, value creation context, which justified some deviation from the mainstream statistical approach. The method of data collection made it possible for the analysis to focus on identifying the significant differences between online e-government users and citizens choosing offline governmental services – in terms of adoption factors and in terms of perceived value creation as well. This form of analysis can provide useful results for practitioners, policymakers as well. So, to test the relationships the researchers used standard inferential statistical metrics, association metrics and statistical tests to identify significant

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differences between the groups of online and offline government service users. Being aware of the limits of the measurement scales used in the data collection not only ANOVA-based mean tests, but also nonparametric Mann Whitney *U* test and median tests were employed to identify significant differences of distributions and medians.

Focusing on the first research question, to analyse and test the differences in the adoption factor levels between the groups of online and offline service users the following methods were applied (Hunyadi et al. 2000):

- ANOVA test to identify the significant differences in factor means ($P < 0.05$; $P < 0.01$);
- Nonparametric median test to identify the significant differences in factor medians ($P < 0.05$);
- Nonparametric Mann Whitney *U* test to identify the significant differences in factor distributions ($P < 0.05$) and
- Chi square test ($P < 0.05$) in the case of the categorical variable of gender.

With these statistical tools we could identify the distinctive factors characterizing e-service users, thereby identifying the significant factors influencing online government service adoption. The same set of statistical tests were used to answer the second research question, to identify the perceived value elements that significantly differ between offline and online users, to define the ones that are associated with electronic government service use.

4. RESULTS

In Table 3, all the connections are indicated, where statistically significant differences were found between mean or median values of online and offline users of administrative government services. In case of adoption factors the displayed (in the second and third columns) factor values for online users were significantly higher than the values for offline users. In case of value elements, the elements mentioned in the fourth and fifth columns were mostly more favourably perceived by online than offline users, but for some elements – displayed in brackets – the difference was in the opposite direction.

Results show that the effort expectancy factor of the original TAM seemed to be influential only in case of four e-government services (8 out of 22 cases), and only on a 5% significance level. On the other hand, habit was a significant differentiator between online and offline government service usage in all 22 analyzed cases, and in 17 instances the habit level of online users is more than 25% higher than others (as a percentage of the range of this variable). Citizens choosing the online government service were also characterized by a significantly higher level of facilitating conditions (18 out of 22 cases), trust in the internet (16 out of 22 cases) and experience (15 out of 22 cases). While the level of internet trust did seem to make a difference in the channel choice, the citizens' level of trust in the government did not significantly differ between the groups of online and offline users (only 4 out of 22 cases).

Results related to citizen value creation were less often significant, but instructive, nonetheless. Citizens found the online administration experience more informative in only 4 cases (of 22), less costly in 5, less time consuming in 3 and altogether a shorter process in 4 cases. This led to a higher satisfaction level of online users (versus the offline ones) only in 6 cases from the analyzed 22 e-government service usage formats. This means that only 3 e-government services,

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Table 3. Summary of the statistical tests' results

Government service areas	Adoption factors found significant		Perceived value elements found significant	
	Information online	Transaction online	Information online	Transaction online
1. Income tax administration	Effort expectancy*, Trust of internet**, Facilitating conditions**, Experience**, Habit**1	Effort expectancy**, Trust of internet**, Trust of government*, Facilitating conditions**, Experience**, Habit**1	Costs*, Length of process**2, Total satisfaction*2	Information gathering**2, Time*2, Costs**2, Length of process**2, Total satisfaction**2
2. Tax administration at municipalities	Facilitating conditions**, Habit*	Trust of internet**1, Facilitating conditions**, Habit**1	-	-
3. Other tax administration at the national tax and customs administration agency	Effort expectancy*, Trust of government**, Facilitating conditions**, Habit**1	Effort expectancy**, Experience*, Habit**1	-	-
4. Administration of government issued documents	Effort expectancy*, Trust of internet**, Trust of government**, Facilitating conditions**, Experience**, Habit**1	Effort expectancy**, Trust of internet**, Facilitating conditions**, Experience**, Habit**1	(Information gathering**2), (Time**2), (Costs*), (Length of process**2), (Total satisfaction**2)	(Information gathering**2), (Total satisfaction*2)
5. Family support administration	Trust of internet**, Facilitating conditions**, Habit**,	Trust of internet**1, Facilitating conditions**, Experience**, Habit**1	-	-
6. Health insurance administration	Trust of internet**1, Facilitating conditions**, Experience**, Habit*	Trust of internet*1, Facilitating conditions*, Experience*, Habit**1	(Total satisfaction*)	(Information gathering*2), (Total satisfaction2)
7. Unemployment administration	Trust of internet**1, Habit*	Experience*, Habit**1	(Time2), (Length of process*2)	-

(continued)

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Table 3. Continued

Government service areas	Adoption factors found significant		Perceived value elements found significant	
	Information online	Transaction online	Information online	Transaction online
8. Social benefits administration	Trust of internet**[1], Facilitating conditions**, Habit**[1]	Facilitating conditions**, Experience**, Habit**[1]	-	-
9. Pension insurance administration	Trust of internet**, Facilitating conditions**, Experience**, Habit*[1], Gender*	Trust of internet*[1], Trust of government*, Facilitating conditions**, Experience*, Habit**[1]	-	-
10. Land registry administration	Trust of internet*, Facilitating conditions**, Experience*, Habit**[1]	Facilitating conditions**, Habit*	-	-
12. Motor vehicle administration	Effort expectancy*, Trust of internet**, Experience**, Habit*[1]	Effort expectancy*, Trust of internet**[1], Facilitating conditions**, Experience**, Habit**[1]	Costs[2]	Costs**[2]

Note: Adoption factor columns: Factor values for online users were significantly higher than factor values for offline users.
[1]Difference in factor is larger than 25% of the range of its value.
Perceived value element coulmns: Online users were characterized by significantly higher satisfaction values for offline users (or in parentheses: where offline users were more satisfied).
[2]Significant distribution differences based on nonparametric Mann Whitney *U* test ($P < 0.05$).
*: $P < 0.05$, **: $P < 0.01$.

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their informational and transactional features, generated more value and satisfaction than their offline versions.

Tables 4 and 5 present two illustrative examples of the detailed statistical results based on their general and online relative frequency (see Table 2):

1. The "administration of government issued documents" is interesting and important as this is the G2C service that concerned the largest groups of citizens ($n = 1{,}041$). To understand, the adoption and value creation of this process can have the largest policy impact on stakeholders.
2. The second example of "income tax administration" service can provide important lessons for policymakers, as this is the service that had the largest online adoption rate of 27%. Understanding the success of this transactional online platform can serve as a best practice for service design on other fields of e-government development.

5. DISCUSSION

5.1. Discussion of implication for e-government research

Concerning only the original factors of TAM our results seem to be less decisive. The effect of performance expectancy is not measurable based on our database and research model, while

Table 4. Administration of government issued documents – summary of the statistical tests' results

Perceived value elements	Information online		Transaction online	
Satisfaction with ...	**No**	**Yes**	**No**	**Yes**
n	815 (84%)	150 (16%)	972 (94%)	59 (6%)
Information gathering possibilities	3.495**[1]	3.236**[1]	3.465**[1]	3.147**[1]
Time	3.230**[1]	2.976**[1]	3.203	3.038
Costs	3.235*	3.054*	3.238	3.011
Length of process	3.243**[1]	3.052**[1]	3.230	3.055
Total satisfaction	3.398**[1]	3.165**[1]	3.383*[1]	3.149*[1]
Factors influencing usage				
Effort expectancy	−0.026**	0.307**	−0.002**	0.366**
Trust of internet	−0.052**	0.571**	0.039**	0.572**
Trust of government	−0.121**	0.192**	−0.098	0.114
Facilitating conditions	0.141**	0.786**	0.183**	0.816**
Experience	−0.016**	0.650**	0.048**	0.873**
Habit	−0.179**	1.001**	−0.017**	1.108**

Note: ANOVA, significant mean differences, $^{*}P < 0.05$; $^{**}P < 0.01$.
[1]Non-parametric Mann Whitney *U* test ($P < 0.05$), significant distribution differences.

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Table 5. Personal income tax administration – summary of the statistical tests' results

Perceived value elements	Information online		Transaction online	
Satisfaction with ...	**No**	**Yes**	**No**	**Yes**
n	296 (81%)	71 (19%)	267 (73%)	101 (27%)
Information gathering possibilities	3.424	3.582	3.409**[1]	3.665**[1]
Time	3.135	3.221	3.103*[1]	3.360*[1]
Costs	3.350*[1]	3.645*[1]	3.368**[1]	3.653**[1]
Length of process	3.256**[1]	3.610**[1]	3.237**[1]	3.626**[1]
Total satisfaction	3.386*[1]	3.630*[1]	3.404**[1]	3.664**[1]
Factors influencing usage				
Effort expectancy	−0.025*	0.245*	−0.026**	0.324**
Trust of internet	−0.037**	0.452**	−0.125**	0.495**
Trust of government	−0.094	0.043	−0.080*	0.188*
Facilitating conditions	0.278**	0.702**	0.184**	0.766**
Experience	0.143**	0.797**	−0.005**	0.941**
Habit	−0.095**	0.809**	−0.263**	1.015**

Note: ANOVA, significant mean differences, $^{*}P < 0.05$; $^{**}P < 0.01$.
[1] Non-parametric Mann Whitney *U* test ($P < 0.05$), significant distribution differences.

effort expectancy (ease of use) seems to be an important determinant in only four out of the 11service areas. One of the reasons behind this surprising result could be that in this research model effects are tested only on actual e-government usage, and not on behavioural intention – while according to the original TAM, effort expectancy has a direct effect on intent to use and not on actual usage, and especially not on continued use.

If we look at the extended UTAUT2 factors, we can see more significant results. Habit seems to be the most important differentiator between offline and online usage in all e-government service areas. This model conceptualized habit as a prior behaviour (Kim – Malhotra 2005), so our results suggest that prior general administrative behaviour and platform choices influence electronic government adoption of Hungarian citizens the most. Habit has been one of the two factors in UTAUT2 with assumed direct effect on actual usage – this direct effect has been found significant originally by Venkatesh et al. (2012) and in case of their research it proved to be one of the major high-impact factors as well. Pásztor – Popovics (2015) also conclude that Hungarians' general negative attitude and habit regarding online administration has a significant influence, obstructing e-government service adoption in the country. Many Hungarian citizens still prefer the familiar ways of traditional, in person administration where there is more room for social interaction (Cseh 2020).

The other factor of UTAUT2 (and UTAUT) with hypothesized direct effect on usage is the factor of facilitating conditions. Facilitating conditions – measured by the accessibility of devices

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and internet connection – are the second most important factor in our study of Hungarian e-government adoption as well. According to a study of the Hungarian Central Statistical Office (HCSO 2015), 76% of adult Hungarian citizens are using computers and the internet – only 1–2% less than the European average (although some differences between rural areas might still exist; Csótó – Herdon 2008). This means that the detected significant effect of facilitating conditions for some Hungarian citizens is not caused by a nationwide lagging behind in terms of ICT penetration.

It was mentioned earlier that internet and government trust are frequent extensions of the TAM/UTAUT model in the e-government literature, and in some cases, they are even the strongest determinants of e-government adoption (Alryalat 2017; Vasvári 2020). Pásztor (2016) has also shown that there is a strong connection between technical infrastructure and knowledge and e-government adoption. The phenomenon that only internet trust has a significant effect on e-government adoption is also not uncommon. The effect of trust in the government was found insignificant in other international (e.g., Powell et al. 2012) and Hungarian studies (Nemeslaki et al. 2016) – and that is what we see in this research as well. Examining a broad spectrum of e-government areas our analysis finds a statistically significant relationship between citizens' trust in the government and e-government adoption only in four cases. Interestingly, three of these cases are tax- and pension related transactions. These seem to be the cases where a higher level of government trust leads to more online transactions, suggesting that when the transaction has serious financial components, than trust in the government matters.

On the other hand, trust in the internet seems to have a significant effect on a wide range of Hungarian governmental e-service areas. This is not surprising in Hungarian context, as the low level of internet trust among Hungarians was one of the factors why Hungary lagged behind in terms of e-commerce and e-payment adoption as well (e.g., Fehér – Varga 2017; Berényi – Sasvári 2018). Concerning Hungarians' e-voting attitude, Nemeslaki et al. (2016) found that internet trust is the second most important factor, and the statistical data collection of HCSO (2015) also stated that 11% of the Hungarian citizens are not using e-government transactions because they do not trust the systems enough to share personal information. But also in other European countries, or on the level of the European Union, building trust is still an important pillar of national digital strategies (Nemeslaki 2014), suggesting that there is a room for improvement in this regard.

Although this model handled the variable of experience differently than the original UTAUT2 by analysing it as a factor and not moderator, the results here are also noteworthy. Based on our analysis, experience of the citizens is a significant differentiating factor in terms of (offline vs. online) administrative channel choice. The results also suggest that experience is more important when citizens have to choose a transactional channel, and less for gathering information online – so to administer online people rely more on their prior experiences of e-transactions. Based on an empirical study, Berényi – Sasvári (2018) concluded that technical background and general utilization of ICT tools were not bottlenecks of e-administration adoption of young Hungarian higher education students anymore – although this might still not be a characteristic of the general population.

As it was stated earlier: the author believes that e-government technology adoption – in the form of citizens starting to use e-government services – is just the first level of success, where the second step would be the value creation for the citizens and/or the government. Our result regarding the value perceived by the Hungarian online e-government service users is not



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especially optimistic (see the 4th–5th columns of Table 3). In 7 out of the 11 service areas there is no significant difference between the offline and online users' perceived level of satisfaction in total, nor regarding perceived cost, time, length of process or information availability. The situation seems to be even less beneficial in case of other three governmental services: here the online users are even less satisfied with the service than the offline ones. This can be partly explained by the potentially higher expectations of online users concerning information, time needs or overall service level, but the fact that online users are less satisfied should still worry the Hungarian policy makers.

5.2. Discussion of implication for practice

Creating value for citizens is an important goal of the national public administration digitalization strategy. Also, a valid value proposition would serve as a tool to transfer more citizens from the more costly traditional administration channels to the potentially more cost-efficient digital ones. Practitioners might be interested in some of the detailed results of analysis on the level of the particular government service areas.

While the overall results regarding value creation are pessimistic, there is one positive example in the given Hungarian e-government service portfolio: the online income tax administration platform. Online transactional users of this e-government service are significantly more satisfied with every examined aspect of the process than the offline users (see Table 5). This is also the service with the highest proportion of online users (27% vs. the average 9.6%). The online platform provides a similar design and user experience to the contemporary web services, citizens might use every day. It is easy to understand, navigate and use. It supports income tax administration with already pre-filled forms (data coming from the integration of administrative databases), so that the citizens' only task is to verify their information. In the last couple of years, the government also launched nationwide communication campaigns to propagate the online service, and the key message of the campaign was that it spares time for citizens. All these carefully designed and communicated characteristics seem to be reflected in our data: online transaction outperforms offline considering effort expectancy and habit. The value elements are confirmed by our analysis as well, making this the only e-service perceived to actually save time and cost for users. While the Hungarian online income tax administration platform seems to be a success story, the 27% adoption rate leaves room for improvement here as well: based on our results for example, increasing citizens' internet trust or improving facilitating infrastructural conditions might increase the number of online users making the process potentially more cost efficient for all stakeholders.

On the other hand, the most frequently used administrative service – the administration of government issued documents – serves with other lessons for government leaders. While many people search for information online regarding this process, only 6% chose the online transactional options. This gives the government an opportunity to have a significant impact on e-government adoption based – partly – on our results as well: by influencing effort expectancy, trust of internet, facilitating conditions, experience or even habit, if possible. Also, looking at the satisfaction levels: citizens seeking online information are less satisfied in every regard than the offline user, while the ones using the transactional e-service are also characterized by a significantly lower level of satisfaction. One could argue that the value proposition of this particular e-service is currently not attractive enough to persuade users to choose the online channel.

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Considering that this is by far the most common public process citizens have to deal with (2 in every 5 people used it in an interval of three years), we can see here a huge untapped potential of creating value for citizens and government alike. Policy makers would be wise to analyze citizens' experience and perceived value elements in depth and this e-service should be improved or even redesigned accordingly. The first steps towards this goal have already been taken with the introduction of the "OkmányApp", an m-government application to promote a flexible digital alternative to citizens for the government issued documents administration (Czékmann – Cseh 2018).

6. CONCLUSION

This paper analyzed the factors of e-government technology adoption and value creation on the empirical base of a large, representative Hungarian sample. The robustness of our findings is increased by the fact that 11, the total spectrum of Hungarian G2C administration service areas were examined. We tested four factors of the UTAUT2 model extended with *trust* to explore e-government adoption factors in the Hungarian context. The analysis found that the key factors differentiating e-government users are online habit, trust in the internet and facilitating infrastructural conditions, while in case of online transactions prior e-commerce experience is also important. This suggests moving toward one of the less used tools to foster e-government adoption: for the government to promote internet-based services in general and create a similar user experience for the e-government service users.

Surprisingly, effort expectancy (ease of use) does not seem to be influential in this context, potentially in part because of its indirect, latent effect mechanism mapped out in the original TAM as well. Another rare finding is that trust in the government is also not a factor of online vs. offline channel choice, except in some cases of governmental services with strong financial elements. One of the novel features of this study is that it combines the theories of technology adoption and value creation, thereby enriching the international research stream and exploring new relationships regarding the positive impacts of e-government. While our results could confirm the relevance of the mainstream technology adoption factors suggested by the literature on our sample, our results concerning the perceived value created by the Hungarian e-government services are less optimistic. So, to answer our second research question: the online users of the majority of the administrative services are not significantly more satisfied than the offline ones, and in case of three e-services using the online version might even be the less satisfying choice. Further research shall explore this counterintuitive relationship further, but this suggests that there is still a room for improvement in citizen-centric e-government development in Hungary by developing more attractive service value propositions. The presented exceptional case of income tax administration could serve as a best practice for future service design: a clear and contemporary, user-friendly interface and a value proposition to actually save time and effort might persuade a larger proportion of users to switch to online administration.

Methodological limitations of our study could also guide future research. A more model-specific data collection method – including direct questions regarding performance expectancy and more detailed Likert-scales to measure – would have supported a more complex analysis, potentially even with Partial Least Squares regression method. On the other hand, our data and analysis could also be useful to draw more in-depth conclusions regarding the individual

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e-government service areas – here we only had room to present the detailed discussion of two e-government service (administration of government issued documents and income tax administration), while other in depth, service-specific analysis could provide deeper policy insights as well.

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