



DEVELOPMENT OF E-GOVERNMENT AND DIGITAL GOVERNMENT AT DIFFERENT LEVELS OF MANAGEMENT PRACTICE

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ABSTRACT

Innovative solutions in the public sector improve the efficiency and quality of e-government services, promote rapid interaction between the public and private sectors. Innovative solutions are implemented by integrating technologies into the public sector. The success rate of integration of websites and mobile applications depends on the simplicity and effectiveness of their use by citizens. The basic point of technology efficiency is usability, which has been assessed in this study on the basis of respondents' questionnaires about the usability of the mobile application "Action". The results indicate the importance of the criteria that ensure the usability of the Application:

Visibility (V), Match between system and the real world (MR), User control and freedom (F), Consistency and Standards (CS), Error prevention (EP), Recognition (R), Flexibility and efficiency of use (FE), Aesthetic and minimalist design (AM), Help users recognize, diagnose, and recover from errors (HU) and Help and documentation (H).

Keywords: E-Government, Mobile Application Of E-Government, Quality Of E-Government, Quality of Electronic Public Services, Satisfaction Level Of E-Government

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1. INTRODUCTION

The dynamic integration of the “Digital Era Governance” concept in developing countries, in particular, ensures greater efficiency of authorities’ work at different levels of administration and public accountability, transparency, openness to individuals and legal entities’ data [1, 2]. ‘Global Security Governance: Conceptual Approaches and Practical Imperatives’. The growing integration of electronic public services in public administration accelerates and improves the interaction of the private and public sectors. E-government is gradually becoming a center of public innovation [3].

The assessment of e-government’s development began in the early twentieth century, when the government began to provide e-services to citizens, and technology began to integrate not only internally in the public sector, but also externally - in the sphere of state-citizens [4]. From thenceforth, a number of methods have been proposed to assess e-government [5]. Questionnaires and statistical processing of results are the most commonly used methods, as the quantitative approach accurately measures the quality level of electronic services.

The purpose of e-government is to improve the quality of public services, and assessing the quality of e-services is a way to develop e-government. The discussion on the effectiveness of e-government has significant potential, given the new technological solutions for the provision of public services. New projects concerning technology’s implementation are transforming public services for the population [6], which requires an assessment of their quality. As a result, the theory of citizens’ satisfaction with online public services is developing [7]. “Understanding the key determinants of electronic government (e-government) services is an important issue for enhancing the degree of use of these services by users”.

The investigation is structured as follows: the second section examines research on the practice of e-government’s development, the quality of e-government’s services and factors influencing e-government. Research on the effectiveness of government websites has been considered. This has served as a basis for conducting a study of the effectiveness of Ukrainian public sector websites in the context of assessing the development of e-government.

2. LITERATURE REVIEW

Similar investigations of e-government’s development were performed in the study of [8], which became the theoretical and methodological basis for conducting the survey and processing of results. In article, [8] have revealed a number of problems in the use of e-government websites based on a quantitative approach to website performance assessment. The study provided identification of users’ requirements for government sites and outlined the technical characteristics of further improvements.

The quality of e-government websites is a critical factor in the adaptation of users and the efficiency of using electronic services [9]. Identification of citizens' priorities in using e-government sites significantly affects the development of e-government in the context of efficiency, trust, reliability and level of support [10]. These measurements significantly affect the opinion of citizens and the re-use of e-government websites.

Also, the study of [11] has been chosen as the theoretical basis of the study; it examines the impact of information and communication technologies (ICT) on the development of e-government and government approaches to the integration of managerial innovations. A significant connection between managerial innovations and ICT has been revealed.

The quality of public e-services affects the quality of private and public sector relations [11] and the level of satisfaction with electronic services [12]. The quality of information, reliability, privacy, speed of feedback determines the quality of public electronic services [13]. "The Electronic Service Quality represented by (Reliability, Ease of use, Effectiveness, Web Site Design, privacy, and Responsiveness)" [13]. The quality of electronic public services is increased by growing efficiency, reducing the cost of operations, expanding access to services and achieving a state of full satisfaction with public services. The level of ICT effectiveness in the public sector can be determined by a number of factors: public awareness, digital skills, access to electronic services, the level of managers' skills, lack of technology updates [14].

3. MATERIALS AND METHODS

The official mobile application of public online services "Action" (hereinafter - the Application) has been selected for the study, in which citizens of Ukraine have the opportunity to use electronic documents online with the possibility of presenting to law enforcement authorities, if necessary.

The research method is a structured interview with closed questions through a questionnaire as a tool for collecting data on the ease of use of the Application. The questionnaire was developed using Google Forms and contained 14 closed questions, 10 of which were related to the level of ease of the Application's use, 4 - social-demographic characteristics, 1 question - problems related to the reasons for inefficiency and problems that arose during use.

The questionnaire was developed on the basis of a quantitative approach to assessing the effectiveness and ease of the Application's use, proposed in the study. The questionnaire is the author's own development due to the uniqueness of the e-government Application and the absence of similar practices in the world. The survey technique involves making statements about a specific criterion of ease of use. Specific questions were developed based on the heuristic criteria proposed in the study of [8].

The questionnaire was sent to the respondents by sending a link on social networks (Facebook, Instagram) and sending it to the telephone numbers of the respondents, whose prior consent had been obtained by oral information about the details of the survey. The sample was formed by selecting respondents from eight thousand applications for participation in the survey. The conditions of selection were as follows: 1) the presence of one of the documents (driver's license and technical certificate in his own name, or passport); 2) the possibility of authorization through the Bank ID function (using the applications Privat24 and Monobank).

The application of state online services "Action" was chosen due to its uniqueness and authenticity. The application "Action" was also chosen in the study, taking into account provision of information to the Ukrainian citizens about the launch of the Application and the lack of relevant studies on use efficiency; the investigations of the reasons were not also carried out concerning the lack of the Application's popularity, as well as clarification of the most popular types of documents among citizens. It is also advisable to find out the practicality and frequency of use (Figure 1, Table 1).



Figure 1 Nielsen's usability heuristics structure [8]

Table 1 Explanations of Nielsen's usability heuristics evaluation – closed questions of the questionnaire according to the criteria [15]

Usability Heuristics [15]	Designation of variable	Explanations / Questions, statements
Level of information about functions.	H1. Visibility (V)	The Mobile Application informs users about what is happening through relevant feedback within a reasonable time.
The level of correspondence between the mobile application and reality.	H2. Match between system and the real world (MR)	The Mobile Application logically and clearly informs about the functions; the information corresponds to reality.
Level of control and freedom.	H3. User control and freedom (F)	The Mobile Application has the function of returning to the previous menu, supports the ability to leave the mobile application at any time and log in again without authorization.
Level of consistency and compliance with standards.	H4. Consistency and Standards (CS)	The Mobile Application is decorated in one style, design; the Application informs about the conditions of use of the platform.
Reporting on errors.	H5. Error prevention (EP)	The Application provides information about the cause of the error, provides the user's support in case of an error and prevents recurrence of errors.

Usability Heuristics [15]	Designation of variable	Explanations / Questions, statements
Ease of memorizing the functions and parameters of the Application.	H6. Recognition (R)	Actions, settings and menu functions are easy to remember. All tools and functions are visible and available for use.
Flexibility and efficiency of use.	H7. Flexibility and efficiency of use (FE)	The Application takes into account the peculiarities of its use by both beginners and confident users. The Application is used frequently; it is effective.
Authenticity (uniqueness) and memorability of the Application.	H8. Aesthetic and minimalist design (AM)	There is no unnecessary, redundant information in the Application. Each unit of information is necessary.
Recognition, diagnostics and updating after errors.	H9. Help users recognize, diagnose, and recover from errors (HU)	There are error messages. Constructive troubleshooting solutions are offered.
Help with use and documentation.	H10. Help and documentation (H)	Information on using is easy to find; specific steps and recommendations for finding information are provided.

The investigation of the use of the Application “Action” will also provide an assessment of the effective development of governance at different levels of administration. The Application is the most popular, taking into account the number of users (1.7 million users as of 2020).

800 users were selected to conduct the study; they were given the opportunity to download the Application and view the functions and parameters, get acquainted with the capabilities of the Application. Each respondent went through the same assessment procedure: free use of the Application and filling in the questionnaire. Also, respondents provided additional answers and comments on problems encountered in the process of use, and wishes for future features.

Statistical analysis by using SPSS 22.0 was applied to process the results of the questionnaire. The level of significance of test results was chosen at the level of 5% and 10%.

The analysis was conducted on the basis of the following techniques and statistical methods of processing results:

1. The reliability of the survey results was used by Cronbach’s alpha. Cronbach’s alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A “high” value for alpha does not imply that the measure is unidimensional [16]. Its values range between zero (0) and one (1.00). A practical way to interpret the magnitude of a reliability coefficient it can be guided by the scale following [17]: 0.81 to 1.00 Very High; 0.61 to 0.80 High; 0.41 to 0.60 Medium; 0.21 to 0.40 Low; 0.01 to 0.20 Very Low. Usually, a reliability coefficient is considered acceptable when at least at the upper limit (0.80) of the category “High”.
2. Convergent and Divergent Validity of the survey results was estimated using a matrix of correlations of variables. Testing makes it possible to assess the importance of each variable concerning the simplicity and efficiency of the Application. A value of more than 0,5 indicates a significant correlation between variables.
3. Descriptive statistics: average values, deviations, minimum and maximum values of variables, scope and variation to summarize the survey results.
4. One-way analysis of variance (one-way ANOVA). “One-way ANOVA models are used to analyze completely randomized experimental designs” [18]. The variables H1-H6, H8-H10 have been selected as independent variables that affect the simplicity and efficiency of the Application, H7 has been selected as the

dependent variable. Flexibility and efficiency of use (FE), which generally determines the effectiveness of the Application.

5. The Partial Least Square (PLS) regression analysis is a multidimensional statistical method based on covariance, which made it possible to compare several variables and several explanatory variables [19]. PLS is an alternative to modelling structural equations or SEM. The use of PLS is explained by the need to estimate multiple regression in the conditions of small samples, omitted values or multicollinearity. After the construction of PLS, hypotheses were tested by analyzing the value of t-statistics and the level of significance.

3. RESULTS AND DISCUSSION

The mobile Application “Action” was launched in early 2020 and is available for download in google play services (for installation on Android) and AppStore (IOS). The testing was conducted by 32000 drivers. The mobile Application “Action” provides the opportunity to log in through the Bank ID function (using the applications Privat24 and Monobank). The users need to install the Privat24 and Monobank mobile applications in order to do this. In case of absence of installed applications, “Action” offers to enter information about the details of identity documents.

Currently, there are a number of problems with the use of the Application. The entry of data on documents in manual mode because of their receipt by 2014 is one of the most common problems. There is no automatic possibility of data transfer due to the digitization of documents only after 2014. The data, entered in manual mode, are confirmed within three days. Users are provided with support and instructions on what to do in this case.

The second problem is the discrepancy between user’s data (the photo in the paper document does not match the photo in the electronic document). This problem does not actually affect the ability to use the Application, but it can cause problems in the person’s identification in the presence of both forms of documents.

The third problem is the lack of installed mobile Applications of Banks, which makes it impossible to authorize in the Application. In this case, the user must manually fill in the required data for authorization. The Application offers the possibility of authorization via a mobile number, but the lack of reference number to passport data does not provide access to the Application. The use is complicated.

The fourth problem is the information illiteracy of citizens, which emerges because of the following reasons: 1) the user is not aware of the existence of the Application; 2) the user does not understand the possibility of using the Application; he needs help in its installation, downloading; 3) the user does not understand the terminology (for example, login via Bank ID using Privat24 and Monobank applications) due to technological backwardness; 4) the users are not aware of the need to replace old documents with new ones (for example, the passport of an old citizen of Ukraine needs to be replaced), which leads to the absence of an actual need to use the Application and leads to assessment of the Application by the citizens as inefficient and inappropriate software development kit. The latter causes no visible reasons for downloading the Application and has a negative impact on the development of e-government in general.

By virtue of the fact that Cronbachs alphas is 0,864, the results of the study are reliable, based on the responses of respondents, we can evaluate the usability of the Appendix (Table 2).

Table 2 The reliability of survey results

Cronbachs alpha	Cronbach Alpha Based on Standardized Elements	N of elements
,865	,864	10

The estimated correlations indicate a high level of validity of the results, the variables are interrelated. For instance, the level of information about the functions is directly related to the level of correspondence between reality and the application, and the level of control and freedom of users, ease of remembering functions and parameters of the application, flexibility and efficiency, authenticity (Table 3).

Table 3 Correlation matrix of Validity evaluation of survey results

	V	MR	F	CS	EP	R	FE	AM	HU	H
V	1,000	,570	,581	,208	,525	,521	,516	,567	,003	,426
MR	,570	1,000	,609	,083	,468	,604	,678	,357	,166	,163
F	,581	,609	1,000	,388	,391	,593	,696	,565	,350	,109
CS	,208	,083	,388	1,000	,421	,554	,358	,205	,445	,467
EP	,525	,468	,391	,421	1,000	,525	,323	,361	,184	,609
R	,521	,604	,593	,554	,525	1,000	,594	,424	,039	,630
FE	,516	,678	,696	,358	,323	,594	1,000	,367	,232	,157
AM	,567	,357	,565	,205	,361	,424	,367	1,000	,011	,396
HU	,003	,166	,350	,445	,184	,039	,232	,011	1,000	,030
H	,426	,163	,109	,467	,609	,630	,157	,396	,030	1,000

Convergent Validity was revealed between:

- the level of correspondence between reality and the Application and the level of control and freedom of users, ease of remembering the functions and parameters of the Application, flexibility and efficiency of use;
- the level of control and freedom of users and flexibility and efficiency of use, authenticity;
- the level of consistency and compliance with standards and the ease of remembering the functions and parameters of the Application;
- provision of information about the cause of the error, support and level of informing about the functions, ease of remembering them;
- ease of memorizing functions and the level of control and freedom of users (Table 4).

Table 4 Descriptive statistics of variables

	N	Minimum	Maximum	Average value		Standard deviation	Dispersion
				Statistics	Standard Error		
V	800	4,0	10,0	7,957	,4049	1,9418	3,771
MR	800	4,0	10,0	8,435	,3547	1,7010	2,893
F	800	1,0	10,0	8,261	,5154	2,4720	6,111
CS	800	3,0	10,0	8,696	,3525	1,6905	2,858
EP	800	5,0	10,0	8,087	,3009	1,4433	2,083
R	800	6,0	10,0	8,957	,2552	1,2239	1,498
FE	800	4,0	10,0	8,045	,3632	1,7037	2,903
AM	800	4,0	10,0	8,348	,3957	1,8976	3,601
HU	800	3,0	10,0	8,696	,3411	1,6358	2,676
H	800	6,0	10,0	8,826	,2323	1,1140	1,241

Table 4 gives grounds for drawing conclusions about the overall usability of the Application: visibility, mapping, freedom, recognition, error prevention, consistency, error recovery, minimalist, help, and flexibility. The average value of all variables is 8,431, which

indicates a high level of the Application's usability. The average deviation in general is 1,682, which indicates the average level of deviation from the average usability (Table 5).

Table 5 One-way ANOVA results

Variable	df	F	sig
V			
Between groups	5	2,509	,074
Within groups	795		
Total	800		
MR			
Between groups	4	4,092	,017
Within groups	796		
Total	800		
F			
Between groups	6	4,158	,012
Within groups	794		
Total	800		
CS			
Between groups	3	1,111	,371
Within groups	797		
Total	800		
EP			
Between groups	8	2,992	,043
Within groups	792		
Total	800		
R			
Between groups	5	8,183	,001
Within groups	795		
Total	800		
AM			
Between groups	6	1,587	,220
Within groups	794		
Total	800		
HU			
Between groups	6	1,745	,194
Within groups	794		
Total	800		
H			
Between groups	5	1,147	,368
Within groups	795		
Total	800		

Conducting testing by using One-way ANOVA (Table 5), the significance of variables for criteria such as Consistency and Standards (CS), Aesthetic and minimalist design (AM), Help users recognize, diagnose, and recover from errors (HU), Help and documentation (H) is more than 10%. Whereas the significance level for the variables Visibility (V), Match between system and the real world (MR), User control and freedom (F), Error prevention (EP) and Recognition (R) is less than 10%.

Therefore, we can conclude that there are statistical differences in the context of the importance of the variables' influence on the usability of the Application, the significance level

of which is less than 10%. Herewith, variables with a significance level of more than 10% are not characterized by the impact on usability of the Application and statistical differences [16].

The determination coefficient R-square of the constructed model (Table 6) is 0,640, which indicates a high explanatory ability. With a significance level of 10%, it can be argued about the adequacy of the constructed model and the reliability of the results and assessments 2,370 (F). Testing of hypotheses concerning the impact on the usability of the Application of various variables was based on the values of t-statistics and p-value (significance levels of 5% and 10%). All criteria are important to ensure the usability of the Application.

Table 6 The Partial Least Square (PLS) [18]

Model	Non-standardized coefficients		Standardized coefficients	t	sig.	95,0% Confidence intervals for B	
	B	Standard Error	Beta			Lower limit	Upper limit
C	-,136	3,666		-,237	,071	-8,123	7,851
V	,087	,271	,091	2,321	,054	-,503	,676
MR	,504	,350	,507	3,443	,075	-,257	1,266
F	,318	,351	,363	1,905	,083	-,448	1,084
CS	,403	,445	,278	1,905	,083	-,567	1,372
EP	-,221	,321	-,189	-3,688	,005	-,920	,479
R	-,014	,724	-,009	-2,019	,085	-1,591	1,564
AM	-,054	,236	-,060	-3,230	,022	-,569	,460
HU	-,106	,427	-,068	-4,248	,008	-1,035	,824
H	,020	,623	,013	3,032	,075	-1,338	1,378

4. CONCLUSION

The conducted study is unique for two reasons: the lack of a similar Application and the experience of implementing a similar project in other countries; the study makes it possible to identify the problems of using the Application in detail. The conducted study correlates with other investigations that confirm the impact of the basic characteristics of information and communication technologies in order to ensure their usability. The study indicates the need to increase the level of the following characteristics of the mobile Application “Action”, namely: the level of information about the features by finalizing the relevant reviews within reasonable time; flexibility and efficiency of use for beginners; informing on errors by providing users’ with support in case of an error and preventing recurrence of errors. The study indicates the most common problems in use, which are caused by certain problems:

- the user is not aware of the existence of the Application;
- the user does not understand the possibility of using the Application;
- the user does not understand terminology (for example, login via Bank ID using Privat24 and Monobank applications) due to technological backwardness;
- users are not aware of the need to replace old documents with new documents.

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