Development of e-governance in Ukraine based on the concept of m-governance

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Abstract: Technological solutions within the concept of m-governance accelerate the provision of public services to citizens under certain conditions. The main prerequisites for efficiency are the expected perception of technology, trust in the government's actions, the expected efficiency and quality of electronic communications. The purpose of the research is to study the trends and problems of e-governance development in Ukraine on the basis of the concept of m-governance through the assessment of the usability of the mobile application of the government "Diia" ("Action"). This study is based on the concept of m-governance, a technocentric approach to quantifying the usability of mobile applications within the digital concept of Ukraine "Country in your smartphone". Based on a survey of 800 users, the usability of the mobile application "Diia" was assessed. The article is based on a comparison of the practice of developed and developing countries. It has been revealed no differences in the effectiveness of the integration of the concept of m-governance. The results prove the importance of usability criteria in the use of mobile applications, but there is no connection between the socio-economic characteristics of users and usability. The study proves the importance of emotional components in the integration of the concept of m-governance: trust, perception, expectations of citizens. Integration strategy and tactics are important, as digital user skills and application specifications (visibility, user control and freedom, consistency and standards, error prevention, recognition, flexibility and efficiency of use, aesthetic and minimalist design, help users recognize, diagnose, and recover from errors, help and documentation). Both the government and citizens are responsible for the effectiveness of technological interaction solutions. The study proves that the government should ensure the formation of confidence in the effectiveness of technology, develop a strategy, tactics of integration based on best practices. On the other hand, citizens are responsible for their own technological readiness through an objective assessment of digital skills.

Keywords: e-governance, m-governance, mobile applications in governance, satisfaction, m-governance application usability.

INTRODUCTION

Technology integration in Ukraine ensures the implementation of the concept of "digital governance" or e-governance (Romanenko, Y. O., 2016). This trend is also a consequence of the introduction of the world experience of governance of developed countries, which provides for the provision of public services using information and communication technologies (ICT) 24 hours a day (Basu, S., 2004; Iatsyshyn, A. V., et al., 2020). "The strategic objective of e-governance is to support and simplify governance for all parties; government, citizens and businesses" (Basu, S., 2004).

E-governance is a component of the concept of "good governance". The prerequisites for the effectiveness of the concept are decentralization of powers and electronic means of interaction between private and public entities. These preconditions apply in Ukraine, in particular, the Ministry of Digital Transformation implements these concepts of governance (Government Portal, 2019).

Governments in developed countries began providing e-services in the early twentieth century, which led to the appereance of research on the effectiveness of e-governance methods (Gronlund, A., 2002). Some studies show that "most e-governance initiatives fail" (Heeks, R., 2001).

The scientific literature offers a number of methods for evaluating the usage of electronic means of government (Huai, J., 2011). Quantitative assessment approaches are the most common (questionnaires and statistical methods of processing survey results). As a result, the theory of satisfaction of citizens with electronic services began to develop (Xiaohong Yang, Yali Zhang, & Chunli Zhou, 2009).

The tendency of increasing mobile users leads to the use of smartphones to receive electronic services. Mobile applications will be the future means of communication between government, citizens and business. Therefore, recent investigations are focused on the theory of m-governance, studying future trends of the use of mobile applications and empirical assessment of public opinion on the effectiveness of m-governance (Faisal, MN, & Talib, F., 2016; Reddick, CG and Zheng, Y., 2017).

A study of the practice of developed countries proves the importance of digital skills as a prerequisite for the use of mobile applications, while Internet access, socio-economic status of the citizen are not so significant (Ebbers et al., 2016).

"Country in a smartphone" is a concept that is integrated by the Ministry of Digital Transformation of Ukraine. Taking the global trends and regional specifics of Ukraine into consideration, the study of the effectiveness of mobile applications is relevant (Government Portal, 2019).

This study includes a study of the practice of integration of electronic tools in public administration of Ukraine, factors which are influencing the development of e-government and analysis of the quality of public online services.

The purpose of the research is to study the trends and problems of e-governance development in Ukraine on the basis of the m-governance concept through the assessment of the usability of the government's mobile application "Diia".

Research objectives are as follows:
1. to investigate the approaches and opportunities of e-governance and m-governance;
2. to identify common problems with the use of the mobile application "Diia";
3. to identify opportunities in order to improve the efficiency of the mobile application "Diia" in the context of attracting more users.

LITERATURE REVIEW

Electronic means are an opportunity to improve public administration. In the scientific literature there are two approaches to "e-governance: techno-centric and governance-centric" (Saxena, K. B. C., 2005). Mobile applications are generally aimed at fast delivery to users of public services, so they are built on a techno-centric approach.

The usage of ICT applications is focused on the speed of public service delivery (Torres et al., 2006), reducing operating costs, although the experience of developed countries proves the lack of planned benefits after integration (Saxena, 2005).

Quantitative evaluation of the effectiveness of e-government was conducted in a number of studies (See Table 1).

Table 1: The results of research on the integration of the concept of m-governance

Author, year	Research methods	Research results
Faisal & Talib (2016)	Brainstorming, literature review, structural modeling	The m-governance integration strategy is a determining factor in the effectiveness of mobile applications
Ebbers et al. (2016)	Survey of Dutch citizens concerning the practice of using electronic means of communication with the state	The level of satisfaction with communication channels depends on the digital skills of citizens. The purpose of the interaction determines the communication channel: online for registration, offline for consultations
Reddick and Zheng (2017)	Regression analysis of an empirical study based on a survey of Chinese citizens	Demand and satisfaction with usage determine the effectiveness of mobile applications
Sharma et al., (2018)	Data collection of 513 Oman mobile application users, use of neural network approach and	Trust, expected performance, efficiency of mobile applications are the most important factors of use and acceptance

	modeling of structural equations	
Dutra & Soares (2019)	Analysis of 12 applications in Brazil and 20 applications in Portugal based on the criteria of service category, coverage area, service area, number of services, access key, application availability	In Brazil, most public services are provided in the field of social security, 60% of services are fashionable to receive through digital channels, 90% of services are online. In Portugal, online services cover social, health and leisure. 50% of services are at the interactive stage, 36% at the informational, educational stages. Most applications provide only 1 service
Changa & Almaghalsahb (2020)	Survey of 100 respondents in Taiwan and processing of results by statistical methods	Numerous usability problems have been identified: navigation, content, accessibility, customization

Source: Compiled by authors

In particular, the study of Changa & Almaghalsahb (2020) has revealed the users' requirements for the state site and identified the technical characteristics of potential optimization.

The quality of the public service delivery channel is a prerequisite for the efficiency of their use and the level of user satisfaction (Jiang & Ji., 2014; Al-Hawary et al., 2016; Rahahleh et al., 2020).

Recent studies define the prerequisites for the effectiveness of electronic services privacy, reliability, information quality, feedback speed, level of access, digital skills and public awareness, technology upgrades (Busaidi et al., 2019; Rahahleh et al., 2020).

MATERIAL AND METHODS

Design, concept and approach

Our study is based on the concept of m-governance (Faisal & Talib, 2016; Reddick & Zheng, 2017) as part of the e-governance paradigm through the conceptual differences between e-governance and e-government (Saxena , KBC, 2005). Nowadays the migration to m-government model in a developing economy is carried out experiencing a very high growth and adoption of mobile communication technology (Faisal & Talib, 2016). Forasmuch as we study usability in the present research on the basis of a survey of citizens of Ukraine concerning the criteria of usability of the mobile application "Diia", consequently, the techno-centric approach lies in the basis of the research.

The study is a quantitative assessment of the effectiveness of the mobile application "Diia", which provides citizens of Ukraine with online services for the presentation of electronic documents to law enforcement agencies in accordance with the concept of "State in a smartphone".

Methodology

The study used a structured interview based on 10 closed-ended questions, each of them met the criterion of usability of the mobile application (See Table 2). An electronic Google questionnaire was used for the interview. The questionnaire also contained 4 questions on socio-demographic characteristics, 1 question on the reasons for the inefficiency of using the mobile application in the process of use.

The questionnaire was first developed due to the uniqueness of the mobile application as a tool for interaction between citizens and the state. The survey involved statements according to each usability criterion presented in the work of Changa & Almaghalsahb (2020). Number of respondents is 800. The study period is June-July 2020.

Table 2: Explanations of Nielsen's usability heuristics evaluation - closed questions of the questionnaire according to the criteria

(Nielsen, 1994) Usability Heuristics (modified by the author according to the Application)	Denoting a variable	Explanations / Questions, statements
Level of information about functions.	H1. Visibility (V)	The Mobile App 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	H4. Consistency and	The Mobile Application is designed in one style, design,

compliance with standards.	Standards (CS)	the Application informs about the conditions of use of the platform.
Informing about the errors.	H5. Error prevention (EP)	The Application provides information about the cause of the error. It provides user support in the situation of an error and prevents recurrence of errors.
Simplisity 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 usage.	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 quite often and is really 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, diagnosis and update after errors.	H9. Help users recognize, diagnose, and recover from errors (HU)	There are error messages. Constructive troubleshooting solutions are offered.
Usage assistance and documentation.	H10. Help and documentation (H)	Information on using is easy to find, specific steps and recommendations for finding information are given.

Source: Nielsen (1994), Changa & Almaghalsahb (2020).

Data collection

The study has involved 800 new users of the mobile application "Diia". Respondents downloaded the application, reviewed the functionality, features and identified problems of its usage. Then the user evaluated the application by filling out a questionnaire. Each user could leave a comment about the problems of use, potential improvements.

Participants were selected randomly by sending a message about the survey through social networks (Facebook, Instagram) using a chatbot. The message provided instructions, a link to the questionnaire and a link where you can download the application. The sample is formed on the basis of the criteria of electronic documents (technical passport in one's name, passport of a citizen of Ukraine for travelling abroad, driver's license) and at the same time the possibility of authorization through BankID (through Privat24, Monobank).

Rationale for choosing an e government website

The mobile application "Diia" was chosen because of the authenticity of this tool and uniqueness. Forasmuch as social sphere and health care are the main areas of application integration in developed countries, consequently, "Diia" provides citizens with access to documents 24/7, which greatly simplifies the interaction with law enforcement agencies. The lack of such interaction tools, the speed of distribution of the application among the population (1.7 million users), the lack of research on the criteria of usability (simplicity, practicality) were the reasons for choosing the object of study.

Statistical methods of processing results

Statistical analysis of the data was performed using SPSS 22.0 with a significance level of 5% and 10% as the most common levels of error probability in the study.

Static processing methods selected:

1. Cronbach's alpha to check the reliability of the results (the value of the coefficient from 0 to 1, the higher value corresponds to the highest level of reliability, a value close to 0.8 is the most acceptable).

2. Correlation analysis of variables (criteria) usability of the mobile application, which provided an assessment of the validity of the results (Convergent, Divergent). A value greater than 0.5 was the basis for estimating the significant relationship between the variables.

3. Average value, standard deviation, maximum and minimum values of variables to summarize the results.

4. Chi-square test and t-test were used to identify differences between the socio-economic characteristics of the respondents and the level of their mastery of the application.

RESULTS

General problems of using "Diia" application

The mobile application "Diia" began to be used in early 2020. And the time of writing the article "Diia" is available for download in the AppStore (IOS) and google play (Android). Users can log in through BankID (in the case of Monobank and Privat24 applications installed. In fact, this determines the audience of users. Another way to log in is to enter information about identity documents.

During the study, users identified problems with the use of the application. The first of them is the manual mode of data entry in case of receiving documents before 2014 due to the beginning of digitization after 2014 of documents. Data confirmation period - 3 days. Users receive instructions and technical support.

The second problem is the differences between the user's data, such as the inconsistency of photos in paper and electronic forms of documents. This further causes the problem of identification.

The most important problem is the unwillingness of citizens to use the application "Diia". Like other types of disruptive innovation, such a digital solution is effective provided the technological readiness of citizens. 23% of users could not use "Diia" due to the lack of applications Privat 24 and Monobank. Despite the fact that the "Diia" has the ability to manually enter data, authorization using a mobile number, users could not log in to the application. Another problem within the limits of technological readiness is that passport data and the user's phone number in Ukraine are not related. Therefore, the level of security of personal data is low.

Lack of digital skills is another problem within the technological capacity of citizens. During the experiment, users noted: 1) ignorance of the application "Diia"; 2) lack of understanding of the possibilities of using "Diia"; 3) lack of understanding of terms (Privat24, authorization, verification, personal data); 4) the presence of old documents makes it impossible to authorize and use "Diia" effectively. These reasons determine in advance the biased attitude of citizens regarding the effectiveness of the application, the feasibility of a technological solution for the provision of online services by the state.

The identified problems indicate a more global issue of integration of the concept of m-governance - technological unpreparedness, bias of citizens, the importance of digital skills. Prejudice about the potential performance of the application may be the result of public distrust. According to a study conducted by Sharma et al. (2018) trust determines the level of acceptance and use of the application.

Analysis of the results of use efficiency and usability of the Application

The reliability of the results of the questionnaire was confirmed by Cronbach's Alpha score with a value of 0.79, which confirms the reliability of the data on the usability of the Annex. The validity of the results was confirmed by correlation analysis (Table 3). Pearson's correlation coefficients range from 0.3 to 0.6.

Table 3: Correlation matrix of evaluation Validity of survey results

Correlation

	1	2	3	4	5	6	7	8	9	10
V	1	,584**	,884**	,453*	,537**	,592**	,516*	,609**	,339	,269
MR	,584**	1	,577**	,190	,484*	,621**	,678**	,388	,246	,114
F	,884**	,577**	1	,873**	,401	,650**	,696**	,590**	,661**	-,065
CS	,453*	,190	,873**	1	,403	,608**	,358	,332	,754**	,140
EP	,537**	,484*	,401	,403	1	,543**	,323	,387	,243	,547**
R	,592**	,621**	,650**	,608**	,543**	1	,594**	,477*	,288	,494*
FE	,516*	,678**	,696**	,358	,323	,594**	1	,367	,232	,157
AM	,609**	,388	,590**	,332	,387	,477*	,367	1	,211	,309
HU	,339	,246	,661**	,754**	,243	,288	,232	,211	1	-,155
H	,269	,114	-,065	,140	,547**	,494*	,157	,309	-,155	1
Salary	-,067	-,033	-,210	-,165	-,317	-,244	-,224	-,116	,082	-,047
Passport	-,078	-,044	,183	-,134	,157	-,062	,000	-,079	,000	-,068
DriverDoc	-,230	-,352	-,026	,065	-,112	,152	-,112	-,193	-,276	,101

**. Correlation is significant at the 0.01 level (two-tailed).

*. Correlation is significant at the 0.05 level (two-tailed).

Source: author calculation, SPSS 22.0

Correlation analysis of usability criteria confirmed Convergent Validity between: 1) levels of correspondence between reality, application environment and control, freedom of use, ease of remembering parameters, application functions, efficiency and flexibility;

2) levels of control and freedom of users, flexibility and efficiency of use, authenticity of the application;

3) levels of compliance with standards, consistency, ease of memorization of parameters and functions of the Application;

4) providing information about the causes of the error, possible support, providing information about the functions, ease of memorization;

5) the ability to easily remember the functions, level of control, freedom of the user.

Table 4: Descriptive statistics of variables

Descriptive statistics

	N	Min	MAX	Average	Standart deviation
V	800	4,0	10,0	7,957	1,9418
MR	800	4,0	10,0	8,435	1,7010
F	800	1,0	10,0	8,261	2,4720
CS	800	3,0	10,0	8,696	1,6905
EP	800	5,0	10,0	8,087	1,4433
R	800	6,0	10,0	8,957	1,2239
FE	800	4,0	10,0	8,045	1,7037
AM	800	4,0	10,0	8,348	1,8976
HU	800	3,0	10,0	8,696	1,6358
H	800	6,0	10,0	8,825	1,1140

Source: Compiled by authors, SPSS 22.0

Based on the data in Table 4, we can conclude about the overall usability of the Application "Diia" and components: visibility, freedom, mapping, recognition, consistency, error prevention, error recovery, help, minimalist, and flexibility. The average value of the usability elements is 8,431 and confirms the high usability of "Diia". The standard deviation is 1,682 and confirms the probability of error of all estimated usability elements.

A Chi-square test was used to test the hypothesis about the influence of socio-economic characteristics of the respondents on the criteria of usability "Diia". P-values above 0.01 or 0.05 and a low Chi-square indicate no relationship between variables. With a significance level of 1% / 5%, it is possible to reject H0 about a significant relationship.

The results of the Chi-square test (See Table 5) show that there is no relationship between socio-economic characteristics and ease of memorization of functions and parameters of the Application, flexibility and efficiency of use, the need for users to help use the Application. That is, the use of the application in Ukraine does not depend on age, gender, salary, position, availability of an identity document.

Table 5: Chi-square test results

	Age	Sex	Salary	Position	Passport	DriveDoc
Chi-square						
H6. Recognition (R)	4.553	2.504	42.912	2.585	9.216	2.933
H7. Flexibility and efficiency of use (FE)	7.741	3.274	54.542	6.455	6.155	8.433
H10. Help and documentation (H)	8.978	1.225	34.972	3.140	7.545	4.315
p-value						
H6. Recognition (R)	0.804	0.644	0.199	0.629	0.324	0.938
H7. Flexibility and efficiency of use (FE)	0.654	0.658	0.156	0.264	0.802	0.587
H10. Help and documentation (H)	0.344	0.874	0.517	0.535	0.479	0.828

Source: Compiled by authors, SPSS 22.0

T-test was used to test the average differences between the socio-economic characteristics of citizens and the criteria of usability "Diia" (Table 6). For example, the test allows determining whether there is a significant difference between the level of flexibility and use of the Application by men and women.

Table 6: Mean t-test results Group Statistics

	Position	N	Average	Standart deviation	Average error of mean
Flexibiliny and efficiency of use (FE)	Ordinary	16	8,188	1,5152	0,3788
	Leader	6	7,667	2,2509	0,9189

Criterion for independent samples

		Livsgne's test for equality of variances		t-test for equality of means						
		F	Meaning	t		Mean (2-side)	Average difference	Mean square error of difference	95% confidence interval for the difference	
									Low	Upper
Flexibiliny and efficiency	**Equal variances are**	1,569	0,225	0,629	20	0,536	0,5208	0,8276	-1,2054	2,2471

of use (FE)	assumed									
	Equal variances are not assumed			0,524	6,778	0,617	0,5208	0,9939	-1,8452	2,8868

Source: Compiled by authors, SPSS 22.0

Forasmuch as the value of p-value in the first column (see 'Significance' in the Levene's test for equality of variances) is 0, 225 and the value of the criterion F = 1, 569, we neither reject the null hypothesis of equality of means nor proceed to the analysis of the second column of test results. That is, citizens, namely, managers and subordinates, do not differ in the level of flexibility in the use of the Application "Diia". It confirms once again the lack of connection between socio-economic characteristics and the use of electronic means of communication between the state and citizens.

DISCUSSION

This study confirms that the usability of the mobile application "Diia" as an electronic means of interaction between the state and citizens does not depend on the technical characteristics, although they are interconnected and generally determine the ease and efficiency of use. According to viewpoint of Twizeyimana and Andersson (2019), the public value of e-governance is understood as citizens' expectations from e-governance; consequently, the socio-economic characteristics of citizens-users do not affect the level of usability of the application. It can be assumed that beliefs, trust, expectations of efficiency are prerequisites for the effectiveness of the integration of the concept of m-governance. Similar findings have been also made in studies conducted by Sharma et al. (2018) and Usoro et al. (2019), where trust, expected performance and efficiency are considered as factors in the use of government mobile applications.

At the same time, our study proves that there is no connection between the social-economic characteristics of users and the ease of functions, application parameters and efficiency. We can state that the use of the application in Ukraine as a means of communication between the state and citizens does not depend on their age, gender, income, status. This was also confirmed in a study conducted by Ebbers et al. (2016), which was based on the experience of developed countries and the results obtained by Reddick and Zheng (2017).

For the effective integration of the concept of mobile governance, it is necessary to form the preconditions within the developed strategy. The next stage is the formation of integration tactics, the design must correspond to reality and take into account world experience, effective practice (Heeks, R., 2001).

The low level of use of e-governance technological solutions is determined by the perception of citizens of e-services as being characterized by low quality. In particular, this was confirmed in the work of Zoroja et al. (2020), where the authors identify the perception of service quality and the perception of obstacles to the integration of technological solutions as the main factors of the level of use.

Among the factors motivating the perception of the concept of m-governance, researchers highlight the need for the government to focus on social benefits for the population from the use of mobile applications (Molnar et al., 2017; Mengistu et al., 2009). This especially concerns the involvement of older people in m-governance. Along with this, the use of medical services (Prasad et.al 2013), in particular, services related to the collection of information about the health status of the population (for example, through mHealth devices) and the exchange of metadata with each other, has a positive effect on increasing the number of users of mobile applications of e-government, as well as the provision of appropriate pieces of advice by health professionals. In the context of increasing public confidence in e-governance mobile applications in the current conditions of the COVID-19 pandemic, there is an urgent need for real-time access to medical data on mobile devices in case of critical missions and decision-making (Lomotey & Deters, 2014). In order to increase the spread of m-governance services among the population, it is necessary for the government to create a "needs map" of citizens in electronic services (Molnar & Ko, 2020). One of the options for increasing the efficiency of m-governance is to add local government services to mobile e-governance applications (Laxman et al., 2018) through the creation of joint service centers and a single functionality of e-services of central government and local governments.

No less important motivational elements are usefulness, confidentiality, security, ease of use, which determine the number of users of mobile applications developed by the government. Interactivity is not a significant factor in the intention of citizens to use electronic mobile means of communication with the authorities (Wirtz et al., 2019). However, this study is based on a sample of 161 German students and does not take into account such important characteristics as the experience of the citizen's interaction with the state.

CONCLUSIONS

Most countries in the world support the policy of using electronic means to improve public administration. E-governance with the use of information and communication technologies accelerates the provision of public services 24 hours a day, regardless of a person's location, social status, income level, age, gender and other

factors. The use of ICT applications is focused on the speed of delivery of public services, cost reduction, simplification of access; it is also a factor in increasing public confidence in the government, openness of public services, and transparency of public administration.

The conducted study has made it possible to combine a qualitative assessment of differences in the practice of developed and developing countries in terms of the integration of m-governance concept. Prerequisites for the effectiveness of e-governance are as follows: the emotional component (trust in government, expectations, and perceptions of citizens); strategy, tactics and level of integration of best practices in the implementation of m-governance; technological readiness (digital skills) of citizens. The identified preconditions are of practical importance, as they allow assessing not only the government's actions towards implementing e-governance but also the desire of citizens to use it. Quantitative assessment of the usability of the mobile application confirmed the importance of digital skills of citizens and the lack of connection between the social-economic characteristics of users with the level of use in Ukraine. Failure to comply with these preconditions is the reason for the failure to integrate the concept of m-governance. This means that the government forms trust with citizens through strategy, tactics, practice of integration of the concept of m-governance, while citizens should develop digital skills for a better level of perception and technological readiness for digital change.

Experience forms citizens' trust and sets expectations for the government's action. These important elements of the integration of the mobile governance concept should be taken into account in further research, as well as in the implementation of the concept of development of the Ukrainian application "Diia" and other mobile applications.

JEL Classification: H69 - Other, O31 - Innovation and Invention: Processes and Incentives, J11 - Demographic Trends, Macroeconomic Effects, and Forecasts, R11 - Regional Economic Activity: Growth, Development, Environmental Issues, and Changes.

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