Exploring E-Voting in Moscow Region, Russia: A Survey of Voters' Perception of Trust in Government and Other Factors

Aleksandr Polushin, Yang Lanrong, Muhammad Shemyal Nisar

Abstract: ***The election turnout of 2016 Parliament elections in Moscow was 35.2 % and the voter turnout of 2017 Municipal elections in Moscow was 14.82%. The important question therefore is, what can the state do to improve election turnout? A method than has been applied in various countries in our age and time is the implementation of electronic voting. This increases election turnout and decreases government expenses for the elections. Which way of voting do the voters find to be better? What factors can motivate people to participate in e-voting and what are their expectations from e-voting systems? This research tries to find answers on these questions. An online quantitative survey with around 300 respondents was conducted in Moscow in the beginning of 2018 year. The study reveals that while all of the studied factors are important for e-voting, but availability and trust in government motivates people to participate in e-voting.***

Keywords: Election, E-voting, Intention to Participate in E-voting

I. INTRODUCTION

Elections in Russia are always expensive because of great size of country and because some people live in very remote areas. It is very expensive for state budget to provide them with an opportunity to cast a vote. A method than has been applied in various countries in our age and time is the implementation of electronic voting. This increases election turnout and decreases government expenses for the elections. But is it convenient for people to take part in e-voting? Are voters ready for online voting? Which method of voting do the voters prefer? What factors can motivate people to take part in e-voting and what are their expectations from e-voting systems? This research tries to find answers on these questions. This study is also aimed at evaluation of the perception of voters of Trust in government, availability, ease of use and three other factors capable of influencing their Intention to participate in E-voting.

According to a European Union report, Estonia, Norway and Switzerland are three countries in the union which has successfully implemented internet voting for the general elections(Trechsel, Vasyl, & Silva, 2016). The report lauds the implementation of the system in these countries but does also lament that the system had no effect on the voter turn-out in Norway as well as in Switzerland. Norway, where the system was implemented with the sole hope of improving the voter turnout level, due to no increase in the turnout the system was later abandoned citing the security risks involved in the electronic voting(Trechsel et al., 2016). Whereas, Switzerland did also report no significant improvement in the turnout(Gerlach & Gasser, 2009). On the other hand, Vassil and his colleagues found out that it took three general elections using the E-voting technology for the people to develop the same level of ease with the system(Vassil, Solvak, Vinkel, Trechsel, & Alvarez, 2016). The European union reports suggests to use the Estonian model for introducing E-voting in for the European elections which should be introduced step-by-step as a gradual implementation of the system, in addition to campaigns for voter education regarding the system and necessary regulations and laws for successful working of the system(Trechsel et al., 2016).

Krimmer and his colleagues report, the first of its kind e-voting in Austria for the Federation of Students elections in 2009. The system implemented was a legal binding and enabled remote e-voting for the candidates. The system also included a centralized vote monitoring system for the observers of the process during voting while the voters had been pre-registered prior to the election process(Krimmer, Ehringfeld, & Traxl, 2010).

A rather early report on the subject of electronic voting conducted by Sara Candy in 2002, reports a list of concerns with regards to its implementation(Candy, 2002) are: Security of Data, Security of System (against Fraud, Sabotage, Hacking and Viruses), Reliability of the system (logistic capacity to cope with the demand), Accuracy of the system, Ease of Access, Confidentially and anonymity, Privacy.

II. THEORETICAL FOUNDATION

In this research, the proposed model is based on two research areas: information technology adoption and e-voting system (EVS)[1] design.

Different theoretical models are designed to explain intention by individuals to use technology (Bolgov & Karachay, 2016). One of the important theories is Technology Adoption Model (TAM) (Sedova, 2015), which has been incorporated into various studies.

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EVS [1] E-Voting System

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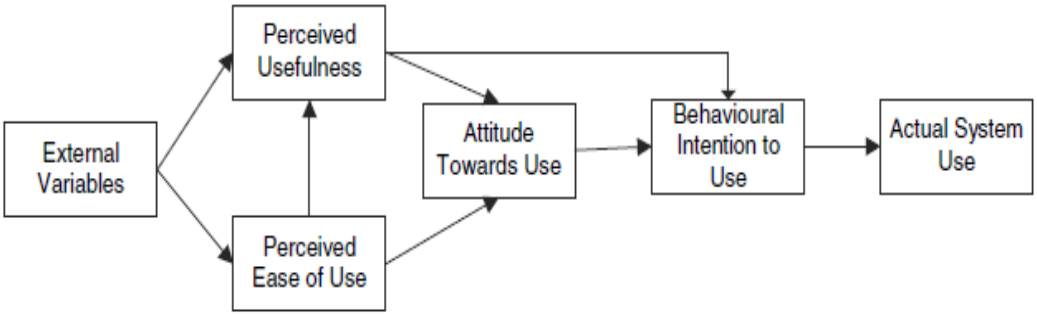

Figure 2.1. Technology Acceptance Model (Davis, 1989).

Other theories, such as Technology-Organization-Environment (TOE) (Akdoğan, 2009), Diffusions on Innovation (DOI) (Kaya, Medeni, Sağsan, Medeni, & Asunakutlu, 2016; Rahman & Ahsan Rajon, 2011).

In the model of Diffusions on Innovation the Intention to Use depends upon Complexity, Image, Relative advantage and Compatibility. In Technology-Organization-Environment the Innovation Decision Making depends upon Technological, Organizational and Environmental factors.

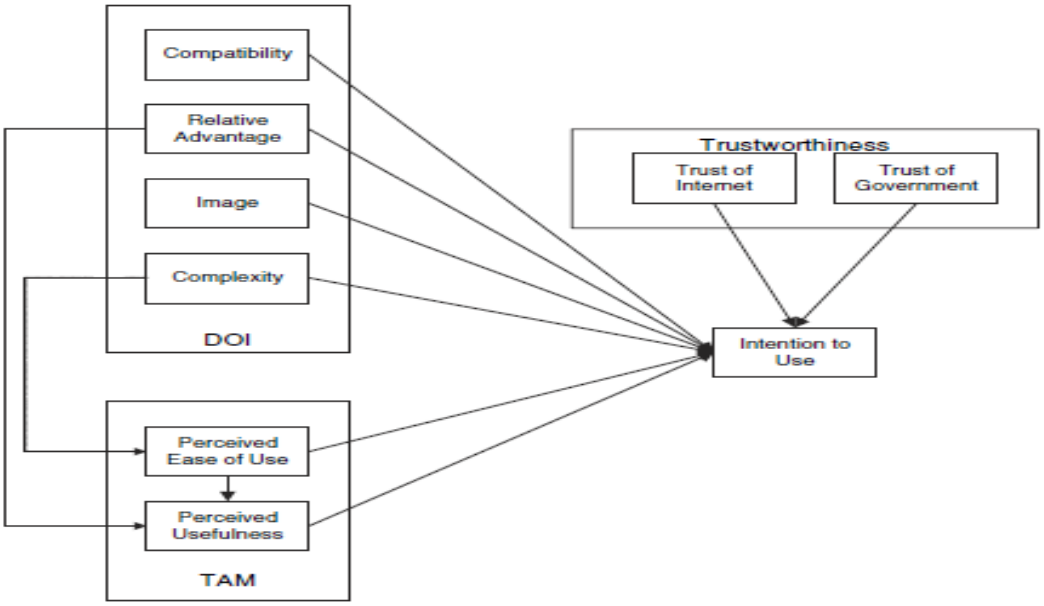

Figure 2.2. Adoption Research (Carter and BÉLANGER 2005)

There were some attempts to develop adoption model with focus on e-voting (Mamay, 2014; Verba, Schlozman, & Brady, 1995). One model, which combines the conceptual and empirical frameworks of these most popular models, is the Unified Theory of Acceptance and Use of Technology (UTAUT), is designed by (Bolgov & Karachay, 2016).

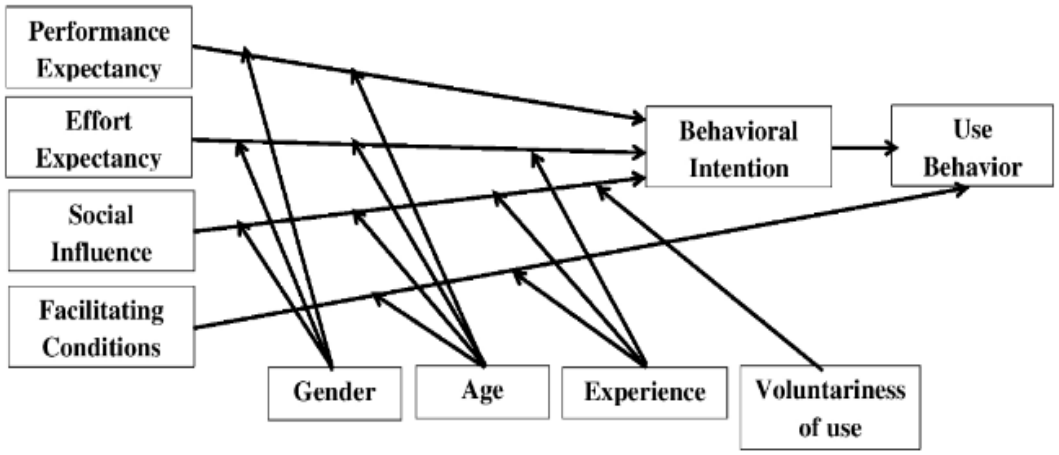

Figure 2.3. UTAUT Model

UTAUT is very good in explaining variance in user acceptance and usage behaviour. UTAUT is composed of four issues: performance expectancy, effort expectancy, social influence, and facilitating conditions.

Using this model for e-voting, three of the issues (without social influence) can be applied to explain Intention to participate in E-voting. These issues have specific requirements of e-voting systems. Performance expectancy directly relates with requirements of privacy, reliability, and security. Effort expectancy is close to ease of use of e-voting system.

Designing an effective e-voting system (EVS) is actually an impossible goal, with the existing architecture of the internet and IT (Bonson, Torres, Royo, & Flores, 2012; Laanpere, Tammsaar, & Sousa, 2011). Developing an EVS is a complex goal. Zissis ("Zadaray Park (In Russian)," 2017) mentioned that complexity included in this system is because of multidisciplinary requirements that must be satisfied. Beyond technological considerations are legal, political, and societal influences("Zadaray Park (In Russian)," 2017).

Each EVS has to satisfy many requirements. They have been sorted as legal, functional, operational, and security requirements. Some of them include: authenticity, availability, eligibility, freedom, practicability, security, verifiability, fairness, and privacy, ease of use, accuracy, and coercion-proof (*Corruption Perception Index 2016 - Transparency International*, 2016, "Zadaray Park (In Russian)," 2017; Öktem, Demirhan, & Demirhan, 2014).

Among these requirements, five requirements are of primary concern security, availability, privacy, ease of use, and reliability. All other requirements are indirectly or directly related to one of the requirements above. This study defines these basic requirements for e-voting:

- Availability: the property of a system to be accessible. This is related to mobility and accessibility. As for e-voting, valid voters are provided with the way to cast their vote. Satisfying this requirement implies protecting the system against any internet attacks have the potential of making the system unavailable. These attacks include distributed denial of service, traffic redirection, connection flooding, hardware based attack and jamming attack ("Zadaray Park (In Russian)," 2017).
- Security: the property of EVS to guarantee voters and voting integrity. It includes security of e-voting components: hardware, software, communications information against different attacks (de GUCHTENEIRE & Mlikota, 2008). These attacks include insider (administrators and programmers), phishing, DNS, spoofing, denial of service, distributed denial of service, automated vote buying, and malware attacks (Bershadskaya et al., 2012b; Bonson et al., 2012; Laanpere et al., 2011; Trechsel et al., 2016). A secure e-voting system guarantees every vote is tamper-proof (Zhao & Zhao, 2010). E-voting systems arguably require the highest possible level of security, exceeding that required for e-commerce (Laanpere et al., 2011; Vinogradovaa & Moiseevaa, 2015; "Zadaray Park (In Russian)," 2017). Security ensures other requirements like integrity, freedom, secrecy, equality, generality, fairness of elections and authenticity("Zadaray Park (In Russian)," 2017).
- Privacy: this is a system's capability that ensures that a particular vote cannot be linked to a voter (*Corruption Perception Index 2016 - Transparency International*, 2016; Vinogradovaa & Moiseevaa, 2015; Zhao & Zhao, 2010); any traceability between a vote and its voter is basically removed (Qadah & Taha, 2007). Such e-voting system ensures that votes are not traceable by the system. So privacy is related with anonymity and confidentiality.
- Ease of use: the characteristic of EVS that helps voters to use it with little or without assistance. Any e-voting system that is easy to use is especially convenient to people who don't have IT skills.
- Reliability: this is close to dependability. It includes a system's ability to perform as required. Such system works exactly as needed. A reliable system guarantees that the voting results are the 100% consequence of the votes cast (Bershadskaya et al., 2012b). For example, any reliable e-voting system must guarantee that no valid vote is rejected, and no invalid vote is accepted (Vinogradovaa & Moiseevaa, 2015). A reliable system is also capable of ensuring accuracy and fairness.

III. UPGRADE OF RESEARCH MODEL

There are various models for e-participation, but not many concerning e-voting. E-voting is one of types of participation but it is not exactly the same. Most of models for E-participation are based on TAM but all of these models are about new technology, even TAM itself was originally designed for new equipment.

Most of these models incorporate factors such as perceived usefulness, relative advantage and so on. When people want to use new technology at work or for some regular activities these factors are important. For instance, president elections in Russia are once per six years so there is no significant perceived usefulness in this matter. It is a very important but rare activity and may not be perceived as useful. So it is better to use models designed especially for e-voting.

Starting with insufficient working models that modelled e-voting, the best available model in the literature is given by Osho and his colleagues (Osho, Yisa, & Jebutu, 2015).

According to the work of Osho and his colleagues, five main requirements independently influence voting. In their model the dependant variable is trust in voting. In this paper, the variable "Trust E-Voting system" was renamed as "Intention to participate in E-voting". First reason is that model of Osho is based on TAM, UTAUT and DOI, in all of them dependent variable is Intention to Use. The terms "Intention to Use e-voting system" and "Intention to participate in E-voting" have similar meaning in this case because when you participate in E-voting, you use E-voting system. Secondly, it is logically that some factors influence Intention to participate in E-voting and are not so important for Trust in E-voting. For instance, Easy to Use should not have an effect on Trust. The main reason for analysing of Intention to participate in E-voting is that for government this characteristic is more important than trust in e-voting system.

It is good that people trust in e-voting system but for government is more important that people USE such system. Of course both factors are interdependent. If people don't trust in e-voting system they will not participate.

According to their model the following hypothesis are analysed in this research:

H1: higher availability affects voters' Intention to participate in E-voting.

H2: higher security of system affects voters' Intention to participate in E-voting.

H3: higher privacy of the system affects voters' Intention to participate in E-voting.

H4: higher ease of use of the system affects voters' Intention to participate in E-voting.

H5: higher reliability of the system affects voters' Intention to participate in E-voting.

At the same time, in many theories of E-participation, many scholars analyse Trust in Government as an important factor. Trust in Government is therefore used in many models for E-participation. For our case, it became evident from the first qualitative stage of this research that Trust in Government is important for many people. So it was decided to add one more hypothesis to that model:

H6: higher Trust in Government affects voters' Intention to participate in E-voting.

So this model is used for this research:

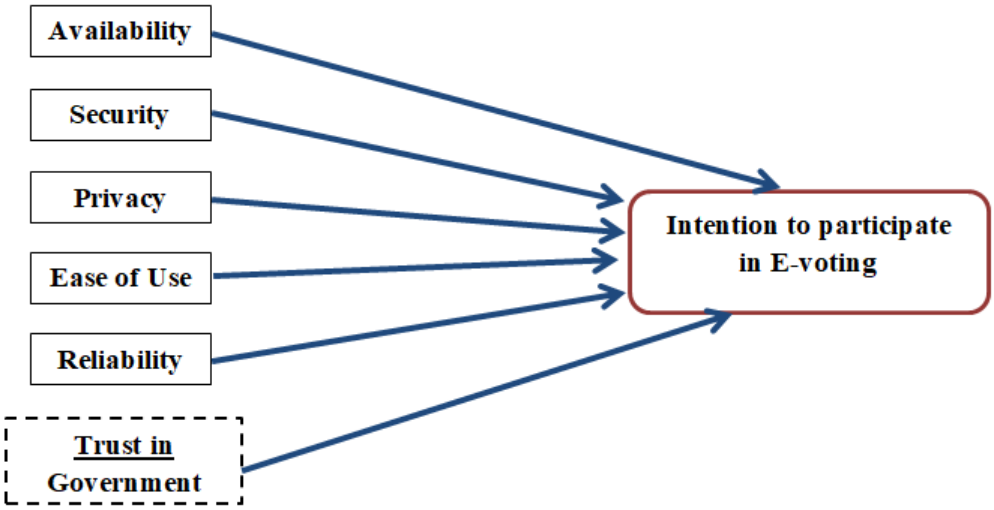

Figure.3.1. Proposed Model of Intention To Participate in E-Voting.

All questions for the variables Availability, Security, Privacy, Ease of Use, Reliability are adopted from (Osho et al., 2015) whereas questions for the variable 'Trust in Government' are adopted from the paper (Abu-Shanab, 2014)

IV. METHODOLOGY

The research is based on quantitative methods. A survey was conducted in the beginning of January and was finished around early March, 2018 in Moscow and Moscow region. A co relational approach using SPSS for quantitative data was used to establish the relationship among variables; whether they have positive or negative relationship. The survey consists of 30 questions taking, on average, under 7 minutes per interview.

The sample selected for this study is based on convenient sampling by the people who were most conveniently available. The questionnaire develops contained structured questions on a 5-point Likert scale. The questionnaire was also posted online. The online method was adopted to maximize the accessibility of participants. This version of the questionnaires was sent to participants via email, Facebook, Vkontakte (Russian Facebook) and different messenger programs, such as Telegram, Whatsapp etc. The survey was distributed in two ways: by sending copies of the questionnaires to friends; and a link to the survey on the social media. We also managed to get help from ex-colleagues, classmates, relatives, ex-girlfriends and friends with the distribution of the questionnaires. The questionnaires from the respondents were collected via Google forms, compiled, sorted, and edited to have the required quality, accuracy. The data was analysed using Statistical Package for Social Scientists (SPSS) and Amos program for SPSS.

For the analysis of the data, SPSS 23.0 was used for the descriptive analysis of sample characteristics, and Amos 25 (the package for SPSS) for confirmatory factor analysis of the constructs. For assessing this model adequacy, Goodness-of-fit index (GFI), comparative fit index (CFI), all should be above 0.9 to have a good fit (Achieng & Ruhode, 2013; *Corruption Perception Index 2016 - Transparency International*, 2016); so in this research GFI = .922, CFI = .940. The root mean square error of approximation (RMSEA), with value from 0.05 to 0.08 is acceptable; in this research RMSEA is equal 0.06 which is a good result. The normed chi-square (x2/df), value should be less than 3, which shows a good fit (Gerlach & Gasser, 2009).

In total, survey had more than 300 respondents.

V. RESULT

5.1. Preferred E-Voting Mechanism

After deletion of incomplete responses, data from 258 respondents was analysed.

Table 5.1 shows the sample characteristics of the respondents. There is no significant bias in sampling in gender 48% / 52%, there is some bias in sampling in age due to online research so it is only one respondent older than 65 years old. At the same time, it was necessary to check that all clusters (Unemployed, Employed and Students) had taken part in the research. So the results of this research could be taken into account for the whole Moscow but it is unlikely that these results could be taken into account without additional analyses for the whole Russia because the level of people who are students or have higher education in Russia is less than 30%.

Table 5.1. Sample Characteristics of Respondents.

	Frequency	Percent
Gender		
Female	125	48.4
Male	133	51.6
Age		
18-24	37	14.3
25-34	144	55.8
35-44	61	23.6
45+	16	6.2
Education		
Higher education/student of University	240	93.0
Collage education	17	6.6
Employment		
Unemployed	25	9.7
Employed	203	78.7
Student	17	6.6
IT proficiency		
Advanced	127	49.2
Average	42	16.3
Expert	88	34.1
Intention to vote		
1 Definitely not	56	21.7
2	31	12.0
3	42	16.3
4	64	24.8
5 Exactly will vote	65	25.2
Preferred voting system		
Online	161	62.4
General voting	78	30.2
Total	*258*	*100.0*

About the preferred voting method, 62.4 % of respondents answered that they prefer online form of voting to the standard manual method.

Table 5.2. Preferred Voting System and It Proficiency

It Proficiency	Online Voting	Manual Voting	Total
advanced	66.14%	27.56%	100.00%
average	54.76%	38.10%	100.00%
expert	61.36%	29.55%	100.00%

Respondents were also asked to rank the 3 different electronic voting platforms, from 1 = mostly preferred to 3 = least preferred. The results are in the Table 5.3.

Online e-voting system has the lowest mean rank. This means that it is the most preferred form of e-voting system. In our research the result is significant ($\chi 2(1) = 2.01$, $p < 0.001$) so voters prefer online voting.

Table 5.3 shows the rank of the E-voting system.

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Table 5.3. Mean Rank of E-Voting Mechanism.

E-Voting Mechanism	Mean Rank
Polling booth/Kiosk voting system	2.00
Web-based EVS	**1.72**
Mobile-based EVS	2.30

5.2. Measurement Model Results.

Table 5.4 shows original level of consistency of each variable.

Table 5.4. Mean, SD and Internal Consistency of Model Factors.

Variable	Items	mean	SD	Cronbach's alpha
Availability	3	4.2209	.76670	0.5650
Security	3	4.8966	.35845	0.609
Privacy	3	4.7016	.56186	0.457
Ease of Use	3	4.7274	.55810	0.736
Reliability	3	4.9096	.38509	0.839
Trust in Government	3	2.9457	.86613	0.525

As you know, for sufficient level of consistency the Cronbach's alpha should be more than 0.7. The variables Ease of Use and Reliability are consistent and other factors, highlighted by grey background in the table above had to be checked additionally.

After analyses of Inter-Item Correlation Matrix in table 5.5 it is shown than mean for all variables is more than 0.3, that is enough. And Minimum in Inter-Item Correlation is more than 0.2 for variables Availability, Security and Privacy so these variables are consistent as well.

Table 5.5. Cronbach's Alpha, Mean, Minimum of Model Factors.

Variable	Items	Cronbach's alpha	Mean	Minimum
Availability	3	0.5650	.342	.242
Security	3	0.609	.383	.241
Privacy	3	0.457	.365	.228
Trust in Government	3	0.525	.323	**.163**

The variable Trust in Government is not consistent: in Inter-Item Correlation Matrix we see that one question 133 have low correlation with the other two variables (highlighted cells).

Table 5.6. Inter-Item Correlation Matrix.

Trust in Government	131.qst	132.qst	133.qst
131.qst	1		
132.qst	.626	1	
133.qst	.180	.163	1

After analysing of data file it became clear that different respondents understand 133th question differently. Question 133: "I trust that citizen's interest is government's first priority".

Some respondents understood this question as: "I trust that citizen's interest is the first priority of THIS Russian government" but some people understood it like "I trust that citizen's interest SHOULD BE government's first priority". Due to these discrepancies, we didn't take into account question 133 improving Cronbach's alpha for the new variable "Trust in Government" to 0.755.

$X^2 = 199.947$, $df = 104$, GFI = 0.922, CFI = 0.94, RMSEA = 0.06, $p < 0.001$

The obtained model fit characteristics are GFI = 0.922, CFI = 0.94, RMSEA = 0.06, X2/df = 1.923, $p < 0.001$. The factor loading of latent variables is from 0.31 to 0.96. As for scales Factor loading is different with values up to 0.351.

Factor loading of variables Security, Privacy, Ease of Use, Reliability is quite low. All the differences are not big so the study shows that all these factors don't motivate people to participate in e-voting. At the same time it doesn't mean that these factors are not important. Most of respondents agree that e-voting should be secure, private, easy to use and reliable. Socio-economic factors are different in different countries and in Russia these factors might not motivate people to take part in e-voting. Maybe the reason is that Russia is European country so it is obvious that e-voting should be secure, reliable etc.

The study shows that most motivating factors are Availability with Factor loading = .298 and Trust in Government with Factor loading = .351. Study shows that Trust in Government is more important factor that Availability. At the same time Factor loading is less than 0.5 for both of them so it means that every factor can improve participation in e-voting but it is more effective to improve both factors for better results.

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VI. CONCLUSION

The main goal of this research is to find factors which are important for e-voting and find factors which can increase Intention to participate in E-voting.

The study reveals first of all availability and trust in government motivates people to participate in e-voting. All factors: Availability, Security, Privacy, Ease of Use, Reliability, Trust in Government are important. The absence of any of these factors would pose serious threats to the number of people who will take part in e-voting. So any electronic voting system has to satisfy all these requirements. Most of respondents agree that e-voting should be secure, private, easy to use and reliable and at the same time Factor analyses shows that factors Security, Privacy, Ease of Use, Reliability does not motivate voters to participate in e-voting. Approximately 80% of respondents have already used E-government systems so privacy, security, ease of use and reliability are must for them. But what really can motivate people to take part in e-voting are two factors, Availability and Trust in Government as explained by various motivation theories (Herzberg, 2003; Herzberg, Mausner, & Snyderman, 1959; LINDSAY, MARKS, & GORLOW, 1967; Sintomer, Herzberg, & Rocke, 2008). Factor Availability is important because people might want to save time and want to cast a vote quickly. From this study, Trust in Government is most important factor.

The study shows that most of people prefer to use e-voting system over the manual voting system. The research shows that this is true for all ages up to at least 44 years old and there is not enough data about older people. At the same time Russia is big and slow country so launching and implementation of such system will take a long time and by the time it does get implemented, the perception would have further improved. Russian government should begin to design such system right now and take all steps towards full implementation of electronic voting. Definitely the electoral reforms will be step-by-step, beginning could be making necessary legislative framework.

Authorities who will design this system should take into consideration the results of this study and decide how to improve Trust in Government. One way to do it is to give some voting ID to every voter and make it possible to publish this ID number on some government website page and the vote casted by this number. So many people if they don't trust such system they can check it and publish their votes and see if their choice calculated correctly. There are might be other ways to improve Trust in government but further studies are necessary about Trust in Government and how to improve it for e-voting system. Also it is quite interesting finding that many people, who are not going to cast a vote, will change their stance for electronic voting.

Around 49% of respondents are going to take part in voting. And about on-line voting 63% of respondents are going to take part in e-voting. It is not possible now to explain this increase. Maybe it is due to interest to the new technology, or people think that IT e-voting system will be more transparent. But it is very interesting result and it means that Russian Government can increase participation in voting by roughly 20% only by launching this e-voting system.

Today's world changes at a very fast pace and it is self-evident that IT is affecting more and more areas of our lives. It is very unlikely that in 50 years' people will use manual voting. This research shows that most of people in Moscow region prefer to use e-voting system even today. The Russian government should, therefore, take steps into that direction with urgency.

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Appendix A

1.Gender? [ ] Male [ ] Female

11. Education? [ ] College graduated [ ] Student /was student of University/not graduated university/Master [ ] IDK

2. Occupation? [ ] student [ ] employed [ ] Non-employed [ ] IDK/other

3. What is your age group? [ ] 18-24 years [ ] 25-34 years [ ] 35-44 years [ ] 45-54 years [ ] 55-64 years [ ] 65 and more

4. Level of IT skills proficiency?

[ ] Novice (requires frequent guidance in the use of computer, its applications and tools)

[ ] Intermediate (requires occasional guidance in the use of computer, its applications and tools)

[ ] Advanced (generally require little or no guidance)

[ ] Expert (serves as a key resource and advices others)

[ ] IDK

41. Which online services have you used previously? [ ] Online Banking [ ] Social Media Sites (e.g. vkontakte, Facebook, Twitter…) [ ] Sending/Receiving Email [ ] Reading/Watching News/Watch movies/search [ ] Any e-government services [ ] IDK

5.Have you ever participated in voting (local government or state level) before? [ ] Yes [ ] No [ ]

51. How likely will you cast your vote for elections? 1 2 3 4 5

52. How would you evaluate the level of corruption in Russia now? 1 2 3 4 5

6.For an election which system of voting would you prefer? [ ] Manual [ ] E-voting [ ] IDK

7.Assuming the following three e-voting mechanisms were all available in an election; rank them according to your preference. Write '1' for your most preferred, '2' for the next preferred, and '3' for the least preferred.

- [ ] Polling booth/Kiosk e-voting system
- [ ] Web-based (on-line Computer-based or mobile app) e-voting system
- [ ] Mobile-based e-voting system via call or sms

71. If a remote/online e-voting platform was implemented now, how would you best rate your trust of e-voting system in Russia? 1 2 3 4 5

For the following statements please indicate (by ticking) your agreement using the scale:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree

	1	2	3	4	5
Availability – An e-voting system should:					
81. Be deployable via mobile and web platforms, and/or a polling station					
82. Have facilities for all eligible citizens, including disabled and old citizens, to be able to vote.					
83. Be accessible right from the time voting starts and all through the period of voting.					
Security – An e-voting system should:					
91. Ensure only eligible voters can access the e-voting system.					
92. Ensure a cast vote cannot be altered by unauthorized person or system.					
93. Be secure against session hijacking, malware, and other forms of attack.					
Privacy – An e-voting system should:					
101. Ensure voters' identification data are secure against unauthorized disclosure and alteration.					
102. Ensure no vote can be traced to a particular voter.					
103. Ensure no attacker can successfully eavesdrop on a voter during voting process.					
Ease of Use – An e-voting system should:					
111. Be easy to learn to use.					
112. Be simple to operate.					
113. Provide help facility readily available to voters in the event of problems with voting procedures.					
Reliability – An e-voting system should:					
121. Ensure no voter can successfully cast more than one vote.					
122. Be able to acquire votes correctly, i.e., any vote cast is rightly recorded.					
123. Not reject valid votes nor accept invalid votes.					
Trust in Government					
131. I trust public departments and institutions					
132. I trust government's capability in providing safe e-services					
133. I trust that citizen's interest is government's first priority					

141. If a remote/online e-voting platform was implemented for next elections, how likely are you to cast your vote? 1 2 3 4 5

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