JEL:O31; 0330
https://doi.org/10.46361/2449-2604.9.3.2022.126-133

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ANALYSIS OF FACTORS AFFECTING ON E-GOVERNANCE AND DEVELOPMENT OF A COGNITIVE MODEL OF ITS DEVELOPMENT

The introduction of digital technologies has made it possible to obtain and spread information at great speed around the world, which has caused significant global changes.

Technological changes have caused the establishment of e-governance throughout the world. E-governance is based on the use of information and communication technologies in the process of governing the country. It has enormous potential for governing state sector. With the introduction of electronic governance, the daily work of the state sector becomes rational, finances, material and human resources are saved; The relationship of the state with society, citizens, regions, business, as well as the relationship between the state structures themselves becomes more effective by using it. As well as, it facilitates and accelerates business administration and citizen services.

The article discusses the issue of developing an effective e-governance system model, which is based on modern digital innovative technology – blockchain. Therefore, the perspective of dynamically developing blockchain technology and implementing an effective e-governance system model using this technology is important.

Key words: *Blockchain technology, Electronic governance (e-governance), Cognitive model.*

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საქართველოს ტექნიკური უნივერსიტეტი
საქართველო

ელექტრონული მმართველობაზე მოქმედი ფაქტორთა ანალიზი და მისი განვითარების კოგნიტური მოდელის შემუშავება

ციფრული ტექნოლოგიების, დანერგვამ შესაძლებელი გახადა დიდი სისწრაფით ინფორმაციის მოპოვება და გავრცელება მსოფლიოს მასშტაბით, რამაც გამოიწვია მნიშვნელოვანი გლობალური ცვლილებები.

ტექნოლოგიურმა ძვრებმა გამოიწვია მსოფლიოში ელექტრონული მმართველობის დამკვიდრება. ელექტრონული მმართველობა ეფუძვნება ინფორმაციისა და კომუნიკაციათა ტექნოლოგიების გამოყენებას ქვეყნის მართვის პროცესში. მას სახელმწიფო სექტორის მართვისთვისს უზარმაზარი პოტენციალი აქვს. ელექტრონულ მმართველობის დანერგვით სახელმწიფო სექტორის ყოველდღიური მუშაობა ხდება რაციონალური, იზოგება ფინანსები, მატერიალური და ადამიანური რესურსები; მისი გამოყენებით უფრო მეტად ეფექტური ხდება სახელმწიფოს ურთიერთობა საზოგადოებასთან, მოქალაქესთან, რეგიონებთან, ბიზნესთან, ასევე თვით სახელმწიფო სტრუქტურებს შორის ურთიერთობა; აადვილებს და აჩქარებს საქმეთა წარმოებას და მოქალაქეთა მომსახურებას.

სტატიაში განხილულია ეფექტიანი ელექტრონული მმართველობის სისტემის მოდელის შემუშავების საკითხი, რომელსაც საფუძვლად უდევს თანამედროვე ციფრული ინოვაციური ტექნოლოგია - ბლოკჩეინი. შესაბამისად, მნიშვნელოვანია დინამიკურად განვითარებადი ბლოკჩეინ ტექნოლოგიის და ამ ტექნოლოგიის გამოყენებით ეფექტიანი ელექტრონული მმართველობის სისტემის მოდელის დანერგვის პერსპექტივა.

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Introduction

For the purpose of managing and operating complex systems effectively, it is necessary to construct system model and to form alternative scenarios of system functioning. Let's act out the scenarios on the model as a model experiment and select the best one from these scenarios.

The article includes the discussion of the issue of managing complex systems on the example of e-governance stability.

The dynamics of e-governance as a complex, difficult to formalize system is related to the interaction of factors affecting it. Despite the influence of factors, the e-governance system should always maintain its qualitative characteristics as a tool for sustainable development of the state [1].

The article proposes a number of factors that, in our opinion, significantly determine the sustainability of an e-governance system. The number of factors affecting the sustainability of e-governance is also very large. Based on the analysis, factors of special importance were selected, the number of such factors is 38 (Table 1). The importance of the factors, i.e. their influence on the main goal, in our case, the sustainability of e-governance, is determined in the range from 1 to 10, where 1 corresponds to relatively low impact, 10 to high one. [2]

Table 1. Factors affecting the e-governance system

	Affecting factors	Importance of factors
1.	Economic factor	7
2.	Technological factor	8
3.	Social factor	7
4.	Political factor	5
5.	Legal factor	6
6.	Environmental factor	3
7.	Financial sustainability level	8
8.	Budget	8
9.	Blockchain technology	8
10.	Digital technologies	6
11.	The development of infrastructure	5
12.	Speed of work	4
13.	Speed of work	6
14.	Digitization of administrative processes/services	7
15.	Availability of administrative processes/services	7
16.	Energy consumption	7
17.	Minimized administrative barriers	4
18.	Internet coverage level (5G)	8
19.	Community Engagement	8
20.	Decision-making speed/time	6
21.	Mobile applications/e-platforms	5
22.	Transparency of the decision-making process	5
23.	The level of public trust towards the government	8
24.	Creation of democratic institutions	4
25.	Legislation regulating government and public feedback	7

26.	Data protection	8
27.	General Data Protection Regulation of EU	8
28.	The legislation of governing cyber-security	8
29.	Investments	7
30.	International level security	8
31.	Information reliability	7
32.	Decentralization	7
33.	Success	6
34.	International image	7
35.	Legal provision	8
36.	Smart contacts	6
37.	Mastering risks	1
38.	Considering the public's opinion as much as possible in decision-making	7

The purpose of the article. After determining the factors affecting the sustainability of e-governance, a cognitive map is drawn up. While cognitive modeling, the development of a situation is considered when it is affected by certain controlling parameters. [4]

To understand the cognitive modeling process, let's introduce some terms:

Target factors - represent “Output” factors. “Output” factors are the factors that determine the essence of the given problem.

Controlling factors - these are the "Input" factors of the model, those factors, through which it is possible to manage the processes in the model by providing controlling influence.

External factors - factors the dynamics of which do not depend on the state of the system. Such factors are used in the model not for the purpose of management, but to reflect the relevant influence of the environment on the modeled system.

The initial state of the model is the state of all factors of the model at the initial moment in time.

The main stages for cognitive analysis and situation development modeling are:

1. **Conceptual study of the system for the current situation,** which means: drawing up a cognitive model by means of a modeling system, determining the basic factors, including determining the relationship between them, forming a goal.

Basic factors consist of two components:

The first - represents the significance of the factor, its value in the modeling system is integers and varies from 0 to 10.

The Second - evaluation of the dynamics of the factor, which can take three values -1, 0 and 1.

Where -1 means that increasing the value of this factor in the dynamics worsens the situation, 1 - increasing the value of the factor in the dynamics improves the situation, 0 - the dynamics of this factor does not affect the situation.

2. Building and researching a cognitive model of the situation. In the process of cognitive model research:

- The necessity of managing the development of the situation is determined.

- Analysis of the goal vector of the development of the situation is carried out on the contradiction in the goal vector, with the agreement of the controlling vector with the goal vector, on the achievement of the goal vector and the effectiveness of the integral influence of the controlling vector.

On the basis of the formed cognitive model, modeling of situations is carried out, the purpose of which is to determine those trends that have a positive effect on the sustainability of e-governance.

Determining mutual dependence between factors - to complete the creation of the model, the mutual influence of factors is determined (that is, which factor affects which factor). If we denote the number of factors by n, then the relationship between the factors will be n x n.

The mutual influence of factors can be direct and indirect. The influence of a factor on a factor is considered direct, if the change of this factor directly affects (influences) the corresponding factor. The influence of a factor on a factor is indirect if the change of this factor does not have any influence on the corresponding factor.

Qualitative (cause and effect) interrelationships between factors on the e-governance system are presented in picture 1 (fragment). The **influence** is represented by a sign (positive or negative +/). The force of influence of one factor on another with numerical values [0, 1].

Picture 1. Cause and-effect interrelationships between basic factors (fragment)

		Importance of factors														
N:	Название фактора	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Political factor	0.2	0.2		0.1	0.1	0.1		0.1	0.1						0.3
2.	Technological factor	0.1	0.2						0.3	0.5	0.4	0.4		0.4	0.2	0.2
3.	Social factor	0.1	0.5	0.1		0.1	0.2		0.4	0.4		0.2	0.1			
4.	Legal factor	0.1	0.3	0.2	0.2				0.3							0.1
5.	Economical factor		0.1		0.1	0.2	0.1		0.2	0.3			0.1	0.1		
6.	financial sustainability factor	0.1	0.1	0.1	0.1		0.1			0.2	0.6	0.1		0.1		0.2
7.	budget		0.6	0.1	0.1						0.3	0.3	0.1	0.1	0.1	0.3
8.	Blockchain technology	0.3	0.3	0.3	0.3	0.1	0.6		0.6	0.6		0.1	0.1	0.1		0.6
9.	Digital technologies	0.4	0.4	0.2	0.2	0.1	0.3	0.1	0.3	0.3				0.2	0.2	0.4
10.	Infrastructural development		0.3	0.1			0.1		0.4	0.3				0.3	0.3	0.4
11.	value	0.3	0.3	0.1	0.3				0.3	0.4	0.3	0.3	0.4			0.1
12.	Spread of the work	0.1			0.2						0.2	0.1				0.3
13.	the availability of administration processes/ services	0.4	0.1	0.1	0.3	0.1	0.3		0.2	0.2	0.4	0.4	0.3		0.1	
14.	the digitizing od administration processes/ services		0.2	0.3	0.3	0.3	0.4		0.4	0.4	0.4	0.3	0.5	0.3	0.3	0.3
15.	energy consumption	0.1	0.1		0.1				0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
16.	minimizing administrative barriers	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
17.	Internet coverage level	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1			0.1	0.1	
18.	Internet coverage level	0.2	0.2	0.1	0.1	0.1			0.2		0.2	0.1	0.1	0.1		
19.	decision making spread/time	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1

After establishing the cause and effect interrelationships between the basic factors, a structural-targeted analysis of the situation is carried out.

The goal vector is determined, by changing of which in the modeling process, the strategic goal of the development of the situation can be studied in different directions.

In our proposed scenario, the following were selected as the target vector:

10. Blockchain technology – 1

26. Data protection – 1

29. Investments – 1

30. International level safety – 1

31. Information availability – 1

Picture 2. Goal vector

The control vector was defined, as the the controlling factors or factors, which can be used to control the processes in the model, the following are selected:

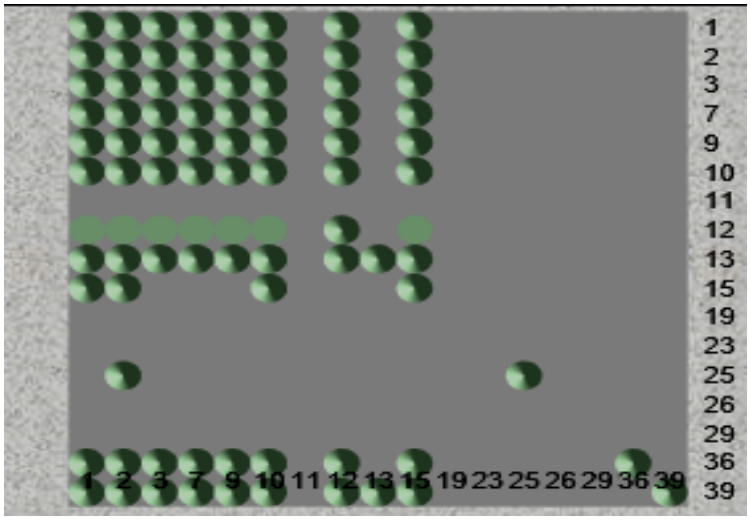
9. Budget – 1

23. The level of public trust towards the government.

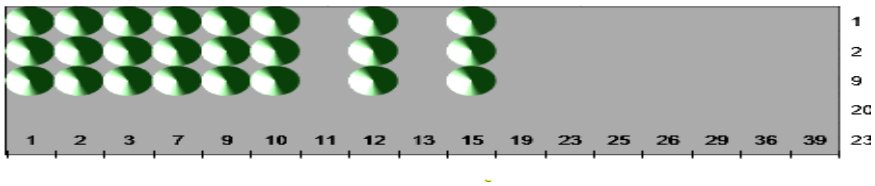
25. The feedback/regulating legislation of the state and society - 1

Picture 3. Controlling vector

The factor change vector was determined. An analysis of the contradiction between the basic factors and the goal vector and the controlling vector was carried out, with the goal-actual analysis (Fig. 4 a, b) it was established that the goals (factors) are not in conflict with each other.



a)



b)

Picture 4. Diagram of vector inconsistency between a) base vectors, b) target vector and controlling vector.

Conclusions

At the next stage, the development of the situation was determined, according to the management situation search algorithm, when it is affected by selected various measures (by management);

According to the abovementioned model, we obtained the determining diagram of the effect of these factors on e-governance (Figure 5), with the selected target and controlling factors.

On the diagram:

- corresponds to the initial value of the goal vector;

- corresponds to the target value of the goal vector;

- corresponds to the predictive value of the goal vector;

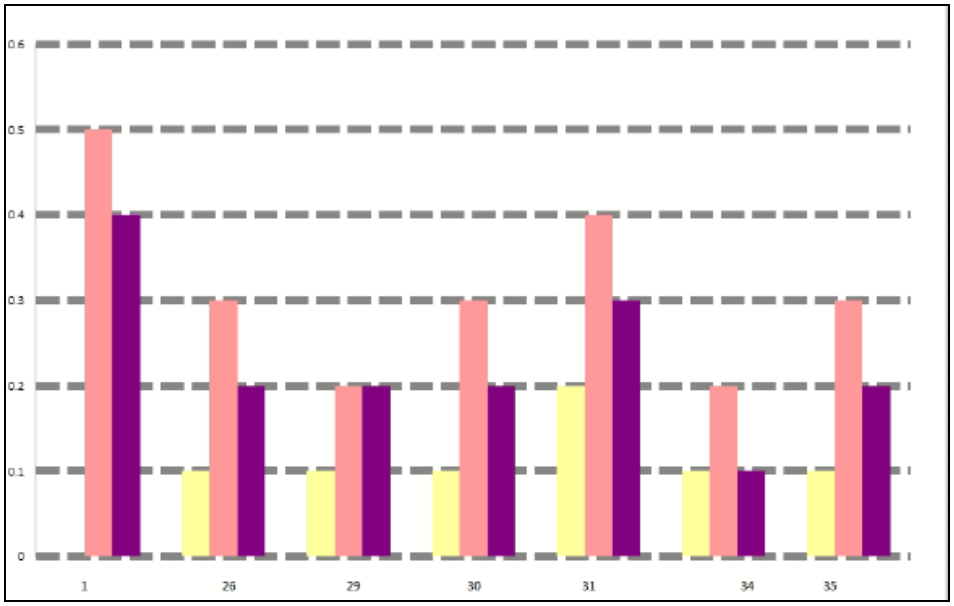


Figure 5. Influence diagram of selected factors according to the goal vector on e-governance.

As a result of the research, it was determined that the level of sustainability of e-governance (factor 1) when it is affected by blockchain technology is positive (increasing), the predictive value increases in relation to the target value, as well as the introduction of blockchain technology effects positively on data protection (factor 26), investment attraction (factor 29), international level security protection (factor 30), information reliability (factor 31), international image (factor 34), and legal provision (factor 35).

From all the abovementioned it can be noted, that with the introduction of innovative technologies, in particular blockchain technology, the qualitative indicators of information use will increase; Investments made in e-governance will ensure the reduction of administrative costs and improvement of governance efficiency; It will contribute to the improvement of the overall democratic quality;

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Citation:

Kiknadze, M., Kapanadze, D., Zhvania, T., Petriashvili, l., (2022) Analysis of Factors Affecting on E-Governance And Development of A Cognitive Model of Its Development. *Innovative Economics and Management: International Scientific Journal, 9(3), 126-134*