The object of this study is the stability of non-governmental organizations (NGOs) of Eastern Europe during crisis phenomena with signs of social and technological transformations. The subject of research is the processes of transformations in the external and internal environment of the activities of non-governmental organizations, which have an impact on sustainability. The sustainability of non-governmental organizations is examined through the Civil Society Organization Sustainability Index (CSOSI). CSOSI allows measuring the impact of global crisis phenomena on the sustainability of an NGO based on the analysis of a number of components. The research was aimed at solving the task to find influencing factors on the activities of non-governmental organizations during the manifestation of crises of various directions. During the study, influencing factors were identified: organizational capacity, society's perception of the organization, and sectoral infrastructure. It is noted that the realm of technological development belongs to the sectoral infrastructure. On the one hand, the imperfection of technology can cause a crisis. On the other hand, technological innovations allow non-governmental organizations to overcome crises. It has been proven that NGO access to new technologies serves as a basis for ensuring the sustainability of the organization. A regression analysis of the influence of factors on the CSOSI index was carried out. An economic-mathematical model was built on this basis. The model proved the significance of the studied indicators, as their p-value remains below 0.05 ($p \leq 0.05$). As a result, this has made it possible to propose an improved model for the development of social innovations under conditions of crisis and uncertainty. The reported results could be used by the founders of NGOs, analytical and consulting companies to construct forecasts of the development of society

Keywords: non-governmental organizations, civil society organization, CSOSI Sustainability Index of Civil Society Organizations, technological innovations

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DETERMINING THE EASTERN EUROPEAN NON-GOVERNMENTAL ORGANIZATIONS SUSTAINABILITY UNDER CRISIS CONDITIONS AND DURING SOCIAL AND TECHNOLOGICAL TRANSFORMATIONS

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1. Introduction

Crisis phenomena often arise due to the underdevelopment of certain areas, and political, social, environmental, technological, and economic instability undermine general stability. The most common crisis phenomena are military conflicts and natural disasters. This becomes a driving force for other dangerous factors, such as mass migration and environmental pollution. In addition, it causes financial and economic instability, fluctuations in the energy market, limited access to modern technologies, poverty and violation of social balance and individual rights. Such crises cause certain transformations, which are characterized not only by the construction of a new structure of society or a change of elites but also by a period of uncertainty, instability, aggravation of technological limitations and social problems that manifest themselves over a long period [1]. Study [2] clearly outlines the impact of technological transformations in the modern era on the activities of society, including their impact on various social movements and public activities.

In crisis transformation processes of society and under conditions of uncertainty, non-governmental organizations (NGOs) demonstrate their stability and value. NGOs provide critical services to their beneficiaries, often respond-

ing faster than governments. After all, it is governments that suffer from bureaucratic red tape and changes in communication technologies and document flow.

Around the world, NGOs are increasingly developing new activities to meet the needs of people in most crisis situations. During the COVID-19 pandemic, their activities included the delivery of food and personal protective equipment to vulnerable populations. Some NGOs also organized campaigns to raise awareness about the virus and prevent its spread and developed educational programs for children. NGOs have also provided support to victims of domestic violence, which has increased in many countries during pandemic-related lockdowns. All of the above cannot be solved promptly in the absence of modern technologies or without the possibility to apply it in the country where the NGO works.

The research problem is to determine the sustainability of NGOs during the crises that Eastern Europe faced at the beginning of the 21st century. The studied period includes a change in the political system of many European countries, caused by the collapse of the USSR, financial upheavals in the world market. This was exacerbated by the COVID-19 pandemic and military interventions (the end of the Yugoslav wars (2001), aggression against Georgia (2008) and Ukraine (2014)). In general, all of the above highlighted new social and technological needs, which NGOs participated in solving. This period was characterized by reduced solvency and job losses, restrictions on movement between countries, and a simultaneous increase in the flow of refugees and migrants to Eastern European countries. This caused social crises due to the low awareness of refugees with modern technologies and the impossibility of getting a job. Based on the above, the relevance of the study is confirmed by the growing need to study factors that have a significant impact on the survival processes of non-governmental organizations under crisis conditions.

2. Literature review and problem statement

In work [3], the term "non-governmental organization" is considered through the understanding of a legal organization created without the participation or representation of any state body. Taking this into account, general technological transformations are analyzed through a separate impact on representatives of society. In study [4], unlike the previous definition, the broader term "civil society organization" (CSO) is used to mean a voluntary association of a group of people, the main goal of which is to achieve common interests, goals and values. And in this case, it is possible to study the peculiarities of the influence of social and technological transformations on the activities of CSOs, the dependence of non-governmental organizations on the trends of social and economic development of the country.

It is worth noting that CSOs and NGOs are practically interchangeable terms in general use [4]. However, in addition to these terms, there are many organizational forms of CSOs. They register as charities, development NGOs, community groups, women's organizations, religious organizations, professional associations, trade unions, social movements, self-help groups, coalitions, and social protection groups. This study will focus on non-governmental organizations.

Modern studies [5] confirm the importance of organized and coordinated work of non-governmental organizations in the management of crisis phenomena in the country, which leads to more effective results. Missions of international humanitarian organizations with local offices are usually the first to respond to the emergence of crisis phenomena [6, 7].

Most international NGOs have provisions in their charters that their activities are aimed at overcoming social crises, including those caused by technological changes. In addition, NGOs are focused on alleviating social tension and providing assistance to vulnerable sections of the population using non-political methods. In order to be effective during crises, NGOs must work with a certain level of resilience – stability in fulfilling their statutory responsibilities and ensuring development results.

There are many models and methodologies for measuring the sustainability of NGOs under different operating conditions. Some methods have been devised to accurately assess the ability of NGOs to respond to crisis situations. One of these procedures was developed in work [8], which evaluates the effectiveness of NGO activities in uncertain situations using logical models to build an algorithm for actions in crisis situations. However, the proposed method is imperfect due to the uncertainty of a number of factors. USAID proposed an additional methodology that quantifies NGO activity in a specific country using the integrated CSO Sustainability Index [9]. Although the assessment does not directly measure NGO activity during crisis situations, it provides an opportunity to observe changes in numerous indicators over time. The Civil Society Organization Sustainability Index (CSOSI) serves as a tool for assessing the sustainability and development of the civil society sector. Experts conduct research in each country, studying the factors that significantly affect the sustainability of non-governmental organizations according to seven critical parameters. The obtained points are averaged, providing a comprehensive understanding of the sustainability of the organization, which allows taking into account crisis phenomena in each country. However, such a definition appears blurred when disparate indicators of NGO activity are summarized.

An analysis of numerous studies that consider the response to COVID-19 examines the inability of the state to effectively manage the crisis when NGOs are unable to cover a wide range of interaction problems. And in the case of the crisis caused by COVID-19, the technological lag inhibits the activities of NGOs [10]. And the beginning of the crisis associated with the introduction of restrictions in society was caused precisely by the insufficient development of information and communication technologies, to which state administration was transferred. Such conclusions indicate the adaptability of NGOs. On the other hand, the study of NGO activities in individual countries [11] shows that prohibitive state policies on NGOs significantly limit their ability to respond to emergency situations. Representatives of NGOs sometimes note that they feel a lack of communication technologies and modern technologies for quick response and provision of assistance under extreme conditions [12].

Often, non-governmental organizations do not pay attention to the demands of society because their sponsors and managers do not conduct a dialog with the people they seek to protect and whose interests they defend [13]. Study [14] investigated control and perception of NGOs by society; it deserves attention in view of its potential impact on organizational sustainability due to certain factors, including due to transformations in the field of technology.

Acquaintance with the relevant literature indicates the presence of a sufficient number of studies and analyzes of NGO activities in response to crisis situations. However, there is a lack of in-depth analysis of certain factors and prerequisites for the sustainable development of NGOs and effective response to challenges during crisis situations, social and technological transformations. Therefore, research into the identification of factors that have a significant impact on the sustainability of NGOs under conditions of crises, as well as social and technological transformations, can be considered expedient.

3. The aim and objectives of the study

The purpose of this study is to identify patterns of influence of certain factors aimed at the survival of non-governmental organizations (NGOs) in periods of social and technological changes and crises. This will provide an opportunity to improve the work of NGOs in terms of adaptation to the conditions of the operating environment, as well as take into account the impact of individual factors on the overall effectiveness of the services provided.

The purpose of the work will be revealed with the help of the following tasks:

– to investigate the peculiarities of activities of non-governmental organizations that operated in the countries of Eastern Europe in the period 2000–2020 and to identify factors that allow non-governmental organizations to quickly adapt and withstand the pressure of crisis phenomena;

– to determine the influence of individual factors on the CSOSI index in terms of sustainability" based on regression analysis and the construction of an economic-mathematical model regarding the sustainability of non-governmental organizations in the period of crises and social and technological transformations.

4. The study materials and methods

The object of our study is the stability of non-governmental organizations of Eastern Europe in the specified period with the identification of the peculiarities of NGO activity during crisis phenomena with signs of social and technological transformations. The subject of research is the processes of transformations in the external and internal environment of activities of non-governmental organizations, which have an impact on sustainability.

The sustainability of non-governmental organizations is considered through the sustainability index. The Civil Society Organization Sustainability Index (CSOSI), developed with the support of the United States Agency for International Development (USAID), was chosen to measure the impact of global crisis phenomena on NGO activities. This index calculates sustainability by analyzing data from seven components of NGO sustainability, using a seven-point scale from 1 to 7. Lower scores indicate a higher level of NGO sustainability. The presented characteristics and levels are based on empirical observations of the development of the sector in the country, and not on a causal theory of development. This index makes it possible to analyze the main strengths and weaknesses of NGOs. In addition, it makes it possible to compare the evolution of the public sector over time and between different countries. The methodology was first developed in 1997 for the countries of Central and Eastern Europe and Eurasia (CEE). CSOSI serves as a valuable tool used by NGOs, governments, donors, academics, and other stakeholders to improve their understanding of public sector sustainability.

For an in-depth study of the impact of crisis phenomena on the sustainability of NGOs, the methodology of regression analysis was used, which was carried out in several stages:

1. Determination of interrelated indicators of influence on the change of CSOSI.

2. Collection of statistical material and its verification according to indicators of the studied period.

3. Study of dependences between features.

4. Construction of regression models.

5. Evaluation of research results and logical analysis of regression equation parameters.

The determination of the interrelated indicators was based on an empirical study of the factors (X_i) – dimensions of sustainable development presented in the framework of the USAID approach, which influence the degree of variation of the CSOSI (Y). In addition, the investigated aspects appeared as a result of expert evaluation of certain indicators. For this analysis, statistical indicators were calculated, which allow us to quantitatively assess the strength of the connection between the values of the factors and the resulting indicator. Such indicators include multiple correlation and pairwise correlation.

The selection of analytical functions for constructing the regression equation is carried out similarly to the selection of functions for the trend equation. A least-squares regression model for hypothesis testing was constructed using the STATISTICA 10 econometric package.

The interaction of CSOSI (Y) with factor characteristics (X_1, X_2....X_n) is described using linear multivariate regression (1):

$$Y_i = a_1 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_n X_{ni}. \quad (1)$$

CSOSI was chosen as the resulting indicator (Y), and the following stability indicators were chosen as the fs factor values:

– X_1 – legal environment (LE) (legislative and regulatory environment that regulates the activities of NGOs);

– X_2 – organizational capacity (OC) (organizational capacity of NGO sector in achieving statutory goals);

– X_3 – financial capacity (FC) (access of NGO sector to various sources of funding);

– X_4 – advocacy (A) (ability of NGOs to influence public opinion and state policy);

– X_5 – provision of services (PS) (ability of NGOs to provide services);

– X_6 – sectoral infrastructure (SI) (availability of technologies for the implementation of NGO services);

– X_7 – public image (PI) (perception of the public sector by society).

Eastern European countries were chosen because many of them have not yet completed the process of social and technological transformation [15]. In these countries, the mentioned process was a consequence of changes in the social structure during the transition from a socialist to a market economy [16]. In addition, each country has unique features regarding these transformations [17]. While some countries experienced only crisis phenomena, others faced protracted crises. For example, related to the war and numerous flows of refugees who could not find work due to

ignorance of modern technologies. COVID-19 affected population migration between individual countries [18].

The regression analysis was performed on the basis of data on 24 countries covering the years 2000–2020, which are considered to be the most crisis years of the last decade. At the beginning of the 2000s, there was an increase in the activity of NGOs in Europe against the background of social and technological transformations. These NGO actions were aimed at meeting the growing need to solve problems beyond the power of an individual or an unorganized group. The years 2000–2010 were marked by the emergence of a large number of NGOs with different programs and different work experience. The main area of activity is accessibility to technologies, development of education, implementation of public initiatives or support of social initiatives. After the global economic crisis, 2010 was a year of recovery, although it was accompanied by a surge in suicides [19]. Until 2009, NGOs worked according to established schemes of interaction with society and state institutions. However, the crisis required adaptation to new conditions, in particular, the transition to information technologies, which led to significant changes in their activities [20]. In 2020, Europe was identified as the epicenter of the global pandemic [21]. New rules and requirements limited the communication of non-governmental organizations with citizens, which created a certain pressure on the need to introduce modern information technologies into work. Thus, in the period from 2000 to 2020, Eastern European countries had to deal with serious crises that affected society and became a difficult test for NGOs.

The research information base was formed using the CSO Sustainability Index Explorer database [9]. Thanks to several parameters included in the CSOSI, it is possible to assess the development trends of NGOs during crises and social transformations that occurred during the studied period, building a model as a function of an independent variable with random variables. The limitations of the study are that it is focused on specific periods, which, although they provide insight into crisis periods, do not take into account development processes.

The study suggests that in periods of crisis, social and technological change, the sustainability of NGOs is somewhat more influenced by their organizational capacity and public perception, despite the strong correlation between the various components of the CSOSI index. These two factors enable donors to make critical decisions regarding the financing of NGO programs, and therefore strengthen the sustainability of these organizations.

5. Results of investigating the activities of non-governmental organizations in periods of crisis

5. 1. Analysis of the impact of external factors on the functioning of non-governmental organizations during crisis events

The CSOSI index for Eastern Europe for two decades – 2000–2010 and 2010–2020 – was chosen for the study. Over time, CSOSI underwent gradual changes: the indicator either increased or decreased by 0.1. As a result, it is the average values of each period that reveal the most significant changes in dynamics. Table 1 gives the differences in the index between the average values for each decade on a specific example.

Table 1

CSOSI in Eastern Europe during crisis events*

No.	Country	Average value 2000–2010	Average value 2010–2020	Difference 2020–2010
1	Republic of Albania	3.9	3.7	–0.2
2	Republic of Armenia	4.0	3.6	–0.4
3	Republic of Azerbaijan	4.7	5.9	1.2
4	Republic of Belarus	5.9	5.5	–0.6
5	Bosnia and Herzegovina	3.7	3.8	0.1
6	Republic of Bulgaria	3.2	3.5	0.3
7	Republic of Croatia	3.1	3.4	0.3
8	Czech Republic	2.7	2.6	–0.1
9	Republic of Estonia	2.0	2.1	0.1
10	Georgia	4.2	4.0	–0.2
11	Hungary	2.8	3.9	1.1
12	Republic of Kosovo	3.9	3.6	–0.3
13	Republic of Latvia	2.7	2.6	–0.1
14	Republic of Lithuania	2.8	2.5	–0.3
15	Republic of Moldova	4.3	3.7	–0.4
16	Montenegro	4.1	4.0	–0.1
17	Republic of North Macedonia	3.6	3.6	0.0
18	Republic of Poland	2.2	2.9	0.7
19	Romania	3.5	3.7	0.2
20	Russian Federation	4.4	4.7	0.3
21	Republic of Serbia	4.3	4.3	0.0
22	Slovak Republic	2.7	3.0	0.3
23	Republic of Slovenia	3.8	3.0	–0.8
24	Ukraine	3.5	3.2	–0.3

*Note: * indicates that the stability levels are grouped into large clusters [9]:*

– increased resistance (from 1 to 3) – the highest level of resistance;

– sustainable development (from 3.1 to 5) – medium level of stability;

– stability under threat (from 5.1 to 7) – the lowest level.

Source: authentic calculations based on the CSO Sustainability Index Explorer database [9]

Eight of the 24 countries analyzed showed the most significant progress in strengthening CSOSI over the past decade. The general trends look somewhat unstable. In 2010–2020, compared to 2000–2010, NGO sustainability increased in Armenia, Moldova, Slovenia, Ukraine, Kosovo, Georgia, and Lithuania. In Belarus, this indicator significantly improved. At the same time, social transformations have worsened somewhat, while technological transformations have improved.

The CSOSI indicator remained largely unchanged when comparing the index of the crisis year with the pre-crisis year. However, in the long term, the sustainability indicators of NGOs show noticeable fluctuations in all analyzed countries. It is extremely important to determine the factors that contribute to the increase of the sustainability index of NGOs in periods of crisis, which will contribute to further planning and strengthening of the activities of the public sector under conditions of uncertainty. Using available statistical data from the CSO Sustainability Index Explorer database, a multivariate correlation analysis of the NGO sus-

tainability index in 24 countries for the period from 2000 to 2020 was conducted. Table 2 gives summary data on the regression analysis of the influence of factor values on CSOSI in the period from 2000 to 2020.

Table 2

Initial data for CSOSI regression analysis

Country	CSOSI	LE	OC	FV	A	SP	SI	PI
	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7
Republic of Albania	3.9	3.8	3.9	4.6	3.4	3.7	4.0	3.8
Republic of Armenia	4.0	3.9	3.8	5.2	3.4	3.9	3.4	3.9
Republic of Azerbaijan	4.7	4.7	4.5	5.5	4.6	4.6	4.4	4.9
Republic of Belarus	5.9	6.8	5.1	6.6	6.0	5.4	5.3	6.0
Bosnia and Herzegovina	3.7	3.4	3.4	4.8	3.1	4.0	3.9	3.4
Republic of Bulgaria	3.2	2.0	4.3	4.4	2.6	3.2	3.1	3.0
Republic of Croatia	3.1	2.8	3.1	4.1	3.2	3.1	2.7	2.9
Czech Republic	2.7	3.0	3.0	3.1	2.3	2.3	2.7	2.5
Republic of Estonia	2.0	1.7	2.3	2.4	1.8	2.3	1.6	2.0
Georgia	4.2	3.3	4.2	5.3	4.4	4.1	4.3	4.1
Hungary	2.8	1.7	3.2	3.6	3.1	2.6	2.2	3.3
Republic of Kosovo	3.9	3.6	3.7	4.8	3.8	3.9	3.6	3.7
Republic of Latvia	2.7	2.4	3.0	3.4	2.2	2.5	2.4	3.3
Republic of Lithuania	2.8	2.1	2.9	3.0	2.1	3.5	3.0	2.9
Republic of Moldova	4.3	4.4	4.1	5.2	3.7	4.5	3.7	4.2
Montenegro	4.1	3.6	4.4	5.0	3.5	4.0	3.8	4.4
Republic of North Macedonia	3.6	3.2	3.7	4.5	3.2	3.8	3.2	3.9
Republic of Poland	2.2	2.2	2.6	2.8	1.8	2.2	1.6	2.2
Romania	3.5	3.5	3.5	4.2	3.4	3.1	3.2	3.7
Russian Federation	4.4	4.8	4.4	4.7	4.1	4.3	3.9	4.7
Republic of Serbia	4.3	4.4	4.2	5.3	3.8	4.3	3.6	4.6
Slovak Republic	2.7	2.8	3.0	3.3	2.6	2.6	2.3	2.4
Republic of Slovenia	3.8	3.5	3.9	4.5	3.8	3.4	3.7	3.8
Ukraine	3.5	3.6	3.6	4.2	2.8	3.3	3.5	3.8

Source: authentic calculations based on data from the CSO Sustainability Index Explorer database [9]

Average indicators were used in the analysis to build an integrated model of factor relationships taking into account combinations of variables. The resulting model has made it possible to determine the key factors contributing to the sustainable development of NGOs in the studied countries.

5. 2. Building a model of the influence of individual factors on the sustainability of non-governmental organizations

In the context of the crisis that gripped the region, it is possible to identify trends that affected the activities of NGOs in various countries of Eastern Europe. As a result of the regression analysis, an economic-mathematical model was built, which takes the following form (2):

$$Y=-0.028+0.16X_1+ +0.13X_2+0.158X_3+ +0.13X_4+0.16X_5+ +0.13X_6+0.114X_7. \quad (2)$$

Calculations show (Table 3) that all factors have a significant impact on CSOSI.

According to Tables 2, 3, all indicators are significant. It should be noted that the elements of organizational potential (X_2) and public perception of the organization (X_7) stand out because their p-value remains below 0.05 ($p \leq 0.05$). Sectoral infrastructure, which takes into account technological changes in the external and internal environment of NGOs (X_6), also has a significant impact on the sustainability of non-governmental organizations, although it is slightly lower than (X_2) and (X_7). But this is not surprising – the impact of technological transformations manifests itself in a longer period, and during this time NGOs manage to adapt to changes.

Table 3

Table of correlation coefficients according to the data in Table 2

Factor	Coefficient	Standard error	t-statistics	p-value
Y	–0.022811355	0.039722446	–0.574268646	0.573771768
X_1	0.162157989	0.012974271	12.49842781	1.13844E-09
X_2	0.137861074	0.028064229	4.912341449	0.000156244
X_3	0.158053637	0.023911917	6.609827109	5.99995E-06
X_4	0.134230369	0.019186048	6.996249085	3.01566E-06
X_5	0.168497775	0.023892551	7.052314193	2.73381E-06
X_6	0.125498409	0.02146418	5.846876439	2.47778E-05
X_7	0.114572891	0.02365812	4.842856912	0.000179918

The results of technological transformations of the specified period in the countries of Eastern Europe are given in Table 4.

It is worth noting that in the period 2000–2020, technological changes took place in arithmetic progression. For the most part, these changes affected information and communication technologies and were related to information processing methods. This gave a quick impetus to the improvement of existing technologies and digitization of all realms of activity, which is why we can talk about transformations in this realm, in parallel with transformations in the organization of society.

Based on Tables 2–4, it is possible to improve the conceptual model of the triad of social innovations proposed in [23]. To this end, it is possible to combine the quantitative assessment of NGO activity in a specific country based on the integrated CSO resilience index during crisis situations (Fig. 1).

Table 4

The most significant impact of technological transformations on the activity of sustil in Eastern Europe in 2000–2020*

Period data	Information and communication technology	Technologies in the energy sector	Technologies in transport	Technologies in the manufacturing sector	Technologies in environmental safety and rational nature management	Technologies in the bioeconomy
2000–2010	«Smart City»	European biofuels (Biofuels)	Safe transport for the environment	Construction technologies	Water purification assurance	Nutrition for Life (Food for Life)
2010–2022	Accessibility and expansion of the functionality of menezh technologies	Clean energy with zero emissions	Logistics networks to fight hunger	Sustainable mineral resource technologies	Freshwater replenishment	Restoration of natural biodiversity

Source: created by author based on data from the CSO Sustainability Index Explorer database [9] and [22]

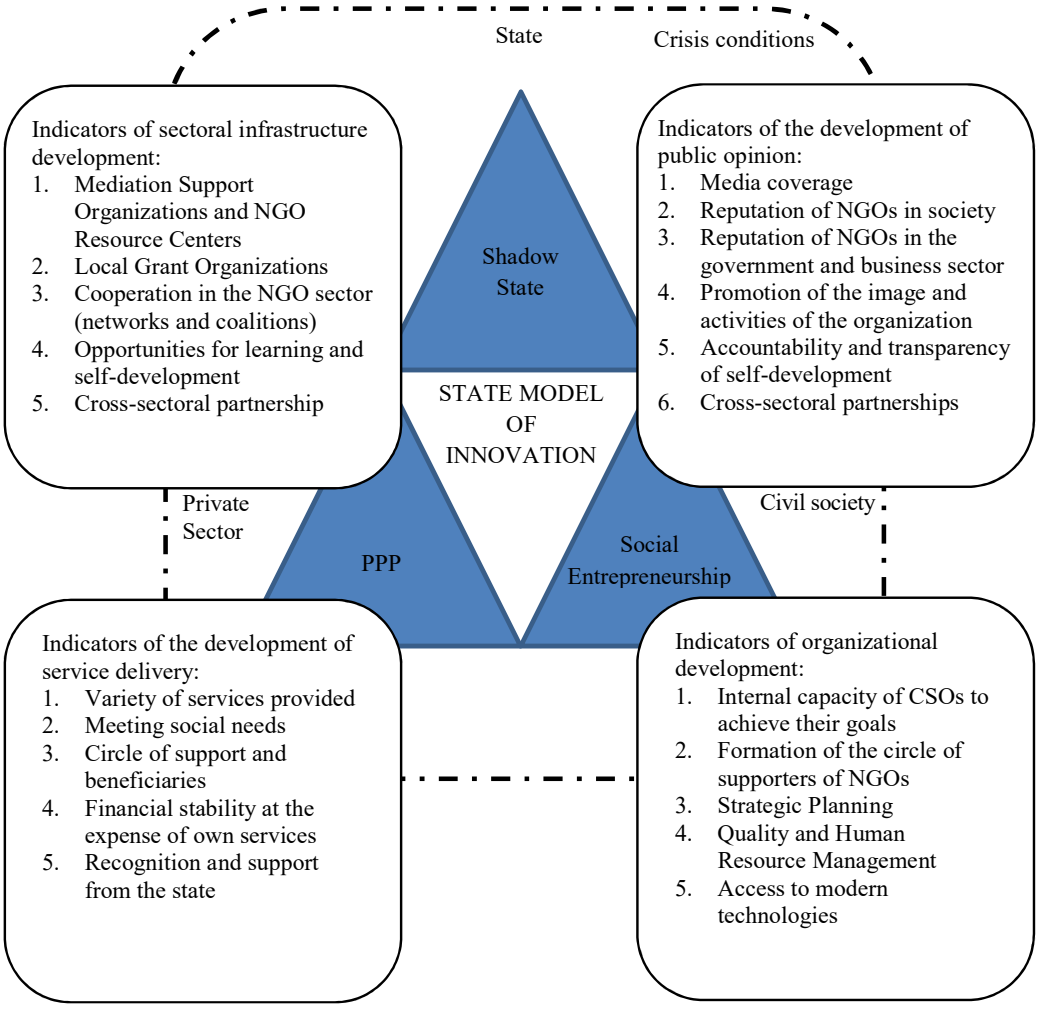

Fig. 1. A sustainable model for the development of social and technological innovations under the conditions of crisis and uncertainty

Source: improved by some author using [9, 23]

The result can be represented as a sustainable model of the development of social innovations, which will make it possible, with the help of social entrepreneurship, to base the work of NGOs on the basis of the technological development of society. In this model, external factors influencing the development of NGOs are given in four basic squares. The key factors contributing to the sustainable development of NGOs are laid down in the triangle of the state innovation model.

6. Discussion of results of investigating the stability of non-governmental organizations under crisis conditions

The results given in Tables 1, 2 illustrate the progress made in strengthening CSOSI by countries such as Armenia, Republic of Belarus, Georgia, Kosovo, Lithuania, Moldova, Slovenia, and Ukraine over the past decade. The increase in the Resilience Index during the financial and economic crisis, which became evident in 2010 and thereafter, does not match the CSOSI trends during the 2020 coronavirus outbreak. Numerous factors could affect the stability index in different periods of the crisis. In particular, during this period, NGOs and society already had sufficiently developed information and communication technologies. However, at the same time, society was still immature enough to accept the technologies of non-governmental organizations.

It should be noted that based on the conducted research [14], it can be assumed that public opinion had a statistically significant influence on the fluctuations of the average CSOSI index in 2000–2010. This can be explained by increased attention to the actions of NGO officials or patterns of behavior that directly affect organizational potential. During this period, crises related to the safety of the environment for humans and the availability of food intensified. Therefore, transformational processes regarding technologies that provide solutions to the specified problems in the period (Table 4) also affected the sustainability of NGOs that were tangential to the specified area. That is, increased attention to NGO officials was associated with technological transformations, as it made it possible to expose some problems and prove facts, as was stated in the paper [12]. In the same way, one can agree with researchers [10], supplementing the statement that technological transformations strengthen the interaction between NGOs and state bodies. This happens by connecting the resources of NGO sponsors to solving problems. The same was demonstrated in the later period of the study, during the outbreak of COVID-19 [11]. The consequence follows from this – changes in one factor could lead to changes in another. The decade spanning

2010–2020 was significantly influenced by factors related to service delivery and industry infrastructure. This was mainly due to the interaction between industries and activities that experienced the most severe recession caused by the COVID-19 pandemic [10].

The case of Ukraine in the study period 2010–2020 illustrates the crisis the country faced in 2014–2020 due to political instability, military aggression, and the COVID-19 pandemic. The country's CSOSI indicator improved by 0.1 points in 2014. However, the technological transformation of the economy took place at a slow pace, and democratic initiatives were restrained by the then leadership of the country. From 2018 to 2020, the CSOSI in Ukraine remained unchanged and equaled 3.2. At the same time, technological development was intensified due to the country's needs to increase its defense capability, and democratic initiatives were oriented to the needs of the population, which had already begun to feel the pressure of armed aggression on the country. In 2018, civil society organizations cared for 1.5 million people affected by war, and in 2020 – approximately 6.9 million people. According to the State Statistics Service of Ukraine, as of January 1, 2021, 92,470 public organizations were registered in Ukraine. In particular, 1,875 public unions, 26,651 religious organizations, 28,713 professional unions, 317 creative unions, 19,812 charitable organizations, 1,649 self-organization bodies of the population. The COVID-19 pandemic has tested the capacity of NGOs to respond to crisis situations and exposed their weaknesses. Due to the pandemic, NGOs have had limited opportunities to provide practical assistance to vulnerable populations, but significant organizations have coped with the new circumstances, primarily by adjusting their activities and attracting additional resources in the field of communication and planning. During the quarantine, these organizations were able to adapt and improve their internal policies, and public perception of their activities played an important role in this process. Civil society organizations diligently fought the consequences of the COVID-19 pandemic, strengthening their authority in the eyes of the public, as it follows from the data in Table 1.

However, it must be taken into account that the specific nature of the crisis may affect the progress of NGOs depending on the sector in which they work [11]. An analysis of the activities of NGOs in Ukraine shows that periods of financial (2008) or political (2014) instability led to the implementation of plans with larger investments [14]. The impact of such factors as the perception of the organization's activities by the public and coverage of its activities in the mass media, as a rule, prevails over state aid to NGOs. This regularity is not accidental because during crises, states tend to shift the focus of their attention to important economic aspects. In particular, this applies to the push for new technological transformations, which are designed to correct the situation by increasing production and improving the personnel potential of organizations.

Shifting society's attention from economic issues to environmental problems contributes to the stabilization of society. This can be traced to the most significant technologies in the period 2000–2010 and 2010–2020 (Table 4). Each of the above-mentioned technologies is based on solving a certain environmental problem that limits the development of society. For example, in Ukraine in 2010–2020, this trend is confirmed, but the occupation of territories prevents the implementation of certain environmental initiatives. In this case, permanent state support for initiatives related to technological and social development of society with the participation of NGOs should be obtained. But this should be combined with coverage of the activities of non-governmental organizations, public recognition, and promotion of the movement in technological transformations. These three factors are the basis for stable development not only in Ukraine but also, based on the analyzed trends, in the society of Eastern Europe as a whole.

The results of the analysis of the 2020 crisis confirmed the opinion of researchers that the accountability of NGOs and the consideration of public opinion are vital [13]. This has an impact on the image of NGOs in the eyes of the public, as well as the fact that the sectoral infrastructure of NGOs is the carrier of certain technological transformations that allow society to go through the crisis period of its development faster or less expensively. Therefore, it is worth noting that among the possible areas of future research is a comparison of reporting results and areas of work of NGOs regarding the impact of technological transformations on society's readiness for independent actions to overcome crisis phenomena. At the same time, it is necessary to find points of governing influence that realize the needs of society through new technologies and innovations in various realms of business.

All the examples given in the work can be explained by the difference in crises. However, after a detailed analysis, it becomes obvious that certain features are the result of the transformation of Eastern European societies, the collapse of the old ideology and the formation of public opinion on overcoming crisis phenomena [1]. In general, the results shown in Table 2, in combination with the indicators of distribution of funds illustrated in Table 3, demonstrate a significant linear correlation. This means that donors should base their funding decisions on NGOs' access to industry infrastructure, where modern technologies occupy a prominent place, and the level of their support from the state, mass media, and public opinion. The considered indicators are not blurred, but rather precise and quantitatively measurable indicators that can be analyzed according to the USAID methodology [9].

It should be emphasized that based on Table 3, technological transformations by factor (X_6) are closely related to the influence of factors (X_2) and (X_7). But this is not surprising – the impact of technological transformations manifests itself in a longer period, and during this time NGOs manage to adapt to changes. Therefore, the given relationship confirms the reliability of the collected data and helps interpret the components of the index according to the "pressure-state-reaction" scheme. In essence, the organization exerts pressure on society through its actions, influencing the technologies for providing services or performing work needed by ordinary citizens to meet basic needs. As a result, external factors such as the state and society as a whole can react to it by adjusting public policy, awareness, and general behavior (so-called "pressure response"). Depending on the direction of this pressure, an NGO may feel obliged to respond to it, either by affirming or questioning its resilience to it.

The model shown in Fig. 1 predicts that the indicators of the development of industry infrastructure can improve thanks to partnerships and coalitions between the state and business. And the latter are the main carriers of technological transformations in society. To align with civil society, PPP initiatives can use public councils and committees, turning PPPs into public-private partnerships (PPPs).

It is in this case that technological development can act as a basic factor on which the model will be built. Then, with the introduction of social entrepreneurship, it is possible to expand the list, improve the quality of NGO services and their financial sustainability, and also generally improve the performance of development services. In addition, increasing the financial stability of a non-profit organization inevitably leads to improved indicators of the Organizational Development Index due to better access to technology and improvement of internal processes. As a result, this increases the ability of NGOs to achieve their goals. This should be taken into account, for example, in Ukraine, where NGO activity takes place under conditions of military aggression. In this case, the practical value of the above can significantly improve the response to the needs of society. Suffering from war.

The limitations of the study are the time frame in relation to the period of consideration of crisis phenomena and influencing factors in this period. Changes in technological development and the completion of transformations in society will also affect the intensity and duration of crises that will arise in the future. Therefore, individual factors in the new period of crisis manifestation may have other features of interaction.

The disadvantage of this study is the use of the CSOSI index as the only procedure for determining sustainability. That is why the development of this study can be seen in the verification of the stability of non-governmental organizations in the period of crises of various manifestations through other indicators to create an integral indicator of the stability of non-governmental organizations in periods of crises and uncertainties. This will allow shifting the emphasis to such an important factor of interaction as social entrepreneurship. Social entrepreneurship can include the development of new legal structures, the promotion of cooperation and the development of strategies for financial support, as well as the development of relations between business and civil society. New products and services affect the organizational capacity of NGOs and their perception by society and the authorities. It is worth noting that social innovations related to the need to reform traditional approaches in cooperation between the state and civil society during the 2010–2020 crisis turned out to be generally ineffective.

7. Conclusions

1. Based on the results of investigating the peculiarities of activities of non-governmental organizations operating in the countries of Eastern Europe in the period 2000–2020, factors affecting the sustainability of NGOs in the period of crisis, social and technological transformations were identified. In particular, this is the organizational capacity of the NGO sector in achieving statutory goals, the perception of the public sector by society, and the sectoral infrastructure. Although the latter does not have a separate intensive influence, it is the basis for ensuring stability during technological transformations in society. The 2019–2020 coronavirus crisis highlighted the importance of new service delivery technologies, industry infrastructure development, and public perception in both crisis situations.

2. Our regression analysis of the influence of factors on the CSOSI index has made it possible to build an economic-mathematical model. This model proves the significance of the studied indicators, as their p-value remains below 0.05 ($p \leq 0.05$). Based on the development, the model of the development of social innovations under conditions of crisis and uncertainty was improved. This model can be applied at the state level and in the public sector to determine strategic orientations and mechanisms for the interaction of stakeholders' interests, as well as for the formation of anti-crisis management strategies. In addition, it contributes to mitigating the consequences of crisis phenomena and effectively overcoming them by developing and improving the relevant quantitative components of CSOSI.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study and the results reported in this paper.

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Data availability

All data are available in the main text of the manuscript.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the presented work.

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