

# Development of Civil Defense Systems and Ecological Safety

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**Abstract**—The multifactorial model of the national security of Ukraine and the main components of the state's economic security has been presented in this paper. An assessment of the economic stability of the state life and the possibility of its falling into a state of chaos has been carried out. Scientific and technical directions of development of the civil defense system as a component of the state's economic security have been proposed.

**Keywords**—national security; economic security; civil security

## I. INTRODUCTION

The sustainable development of Ukraine at the present stage requires the protection of the vital interests of a person and citizen, as well as society and the state, which ensure the timely identification, prevention and neutralization of real and potential threats to national interests. At the same time, national security is a system for optimizing the relationship between conscious threats and the resources that society has to counter these threats. There are always threats to society, but the level of protection from them will not be maximized. Therefore, national security is a dynamic means of achieving and maintaining a balance between real and potential threats and the ability of a subject to counter them [1–5].

## II. LITERATURE REVIEW

Civil defense in foreign countries as a system of strategic provision of state livelihoods is intended for the fulfillment of tasks aimed at protecting the population and the economy of the country in case of emergencies and carrying out salvage operations and other emergency repair operations in the centers of hazard. It was formed in the late 40's - early 50's years of the twentieth century [6–33]. It has been caused by the emergence in the arsenals of

the conflicting countries of nuclear weapons and means of delivery.

In order to solve the problems of peacetime in the late 80's of the twentieth century, in the countries of Europe and other developed countries of the world, the attention of governments has been focused on solving issues of wider use of forces and means of Civil Defense. Natural disasters, accidents and catastrophes in enterprises (especially nuclear and chemical components) that have taken place in different parts of the world have changed the views on Civil Defense as a system designed to ensure the survival of the population and the economy of the countries during the war. The foreign leadership considers the main task of the Civil Defense to form and prepare forces and means to ensure continuous state governance and protect the population and vital sectors of the economy in various emergency situations. Today, in most countries of the world, national civil defense systems are exist and function. The corresponding structure of the organs, forces and means of Civil Defense is clearly formed. Almost all countries have adopted the territorial-production principle of the development of the Civil Defense system, which includes: management agencies; communication systems, alerts, radiation intelligence and dosimetric control; engineered arrangements for evacuation and deconcentration of the population; system of protective structures; stocks of food products, raw materials and tangible assets; forces and means of civil defense, both regular and voluntary. The organizational structure of national civil defense systems in most of the foreign countries has much in common and develops in the direction of further unification.

As a rule, the general management of the Civil Defense operations in foreign countries is carried out by the Ministry of Internal Affairs through existing civil

defense departments with the exception of the USA (civil defense agencies are subordinated to the president), Canada – the Federal Government, Norway – to the Ministry of Justice and Police. The territories in most countries are divided into counties, suburbs, zones, districts, subareas and sectors of civil defense. There are established civil defense headquarters in the administrative-territorial units: states, provinces, cities, communes, communities etc. As can be seen, the actions of the Civil Defense system in foreign countries are considered by the leadership of these countries as protection of the population and the economy from the consequences of natural disasters, accidents, catastrophes and incidents of military conflicts. Since each country builds and formulates its own version of the national civil defense structure by virtue of economic opportunities and physical-geographical, climatic and natural features, but all these systems are guided by a humane purpose, taking into account humanitarian rights in accordance with the Geneva Conventions of 1949.

### III. STATEMENT PROBLEM AND SOLUTION

National security of Ukraine in public areas of operation is divided into the following main types: state, political, economic, energy, demographic, social, cultural, spiritual, scientific, technical, informational, environmental, military and civilian security. These components are characterized by originality, but in accordance Fig.1 stay in relevance and interdependencies.



Fig. 1. Functional diagram of the multifactor system of National security of Ukraine

The basis for ensuring the assessment of the national security effectiveness of Ukraine by the authors, in accordance with Fig. 1, the idea of a local territory with dynamic dimensions, which vary from a point of space (pixel) to the level of an object, city region and state has been laid. The main factor in assessing the safety of this local area is the functional surface the horizontal levels of which coincide with the configuration of the local territory and its convexity correspond to the levels of functioning efficiency of the national security components of Ukraine in cities with specific geographic coordinates [34–38].

Economic security as an integral part of the national security of Ukraine determines the state of national economy protection as well as the system of measures to ensure this protection [39–41].

Assessment of the economic stability of the state's life and the possibility of its falling into a state of chaos in its

work based on the analysis of the dynamic characteristics of Ukraine in the value terms of expectation and dispersion in: gross domestic product ( $S^{GDP}$ ); income level of the population ( $S_{Income}$ ); inflation index ( $S_{Inflation}$ ).

In Fig. 2 – 4 the results of the analysis of the dynamics of the level of economic vital signs in Ukraine in the coordinates have been presented:  $S_k^{GDP} - \Delta S_k^{GDP}$ ,  $S_{Income_k} - \Delta S_{Income_k}$  and  $S_{Inflation_k} - \Delta S_{Inflation_k}$ .

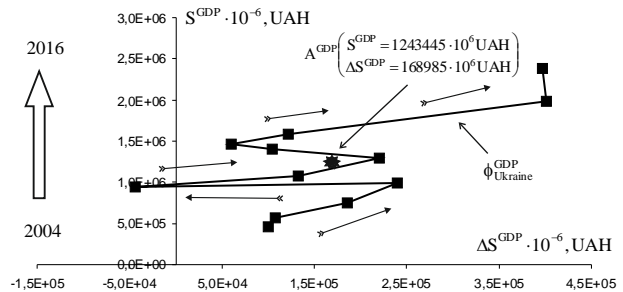


Fig. 2. Generalized dynamic characteristic (on the graph is shown by the function  $-\phi$ ) and the average size of the gross domestic product (on the graph is indicated by the sign  $-\star$ ) for the period 2004 – 2016 in Ukraine

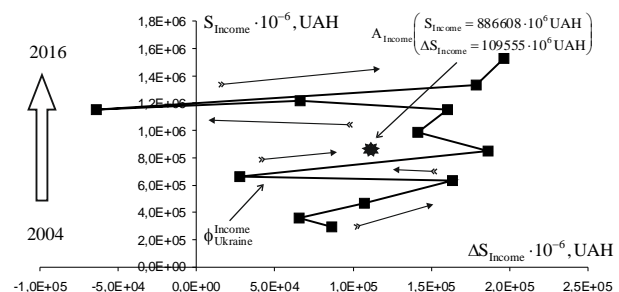


Fig. 3. Generalized dynamic characteristic (on the graph is shown by the function  $-\phi$ ) and the average income level of the population (on the graph is shown by the sign  $-\star$ ) for the period 2004 – 2016 in Ukraine

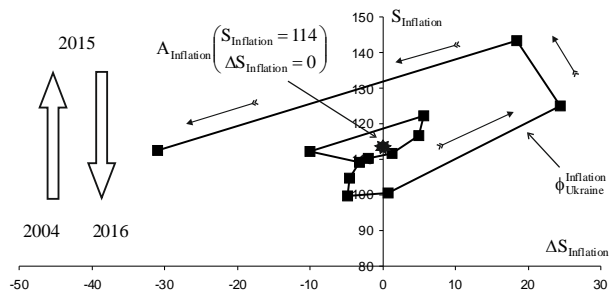


Fig. 4. Generalized dynamic characteristic (on the graph is shown by the function  $-\phi$ ) and the average inflation index (on the graph is shown by the sign  $-\star$ ) for the period 2004 – 2016 in Ukraine

The results of the analysis obtained in Fig. 2 - 4 dynamic characteristics and average indicators on the size of the gross domestic product, population income and inflation index for the period 2004 – 2016 in Ukraine

indicate that the average values of these indicators in the state are at the level  $S_k^{GDP*} = 1243445 \cdot 10^6$  UAH,  $S_{Income_k}^* = 886608 \cdot 10^6$  UAH and  $S_{Inflation_k}^* = 114$ . The average rate of change in terms of gross domestic product, population income and inflation index per unit of time is at the level  $\Delta S_k^{GDP} = 168985 \cdot 10^6$  UAH per year,  $\Delta S_{Income_k} = 109555 \cdot 10^6$  UAH per year and  $\Delta S_{Inflation_k} = 0$  per year, which indicates an increase in the period of time that is being analyzed, of the main economic indicators of the state's life activity in the conditions of keeping inflation at the appropriate level. The level of instability of the functioning of Ukraine in terms of indicators and the size of the gross domestic product, income of the population and the inflation index in the state is equal to:  $\sigma_{S^{GDP}} = 568470 \cdot 10^6$  UAH;  $\sigma_{\Delta S^{GDP}} = 130485 \cdot 10^6$  UAH;  $\sigma_{S_{Income}} = 401388 \cdot 10^6$  UAH;  $\sigma_{\Delta S_{Income}} = 77359 \cdot 10^6$  UAH;  $\sigma_{S_{Inflation}} = 12$  and  $\sigma_{\Delta S_{Inflation}} = 14$ .

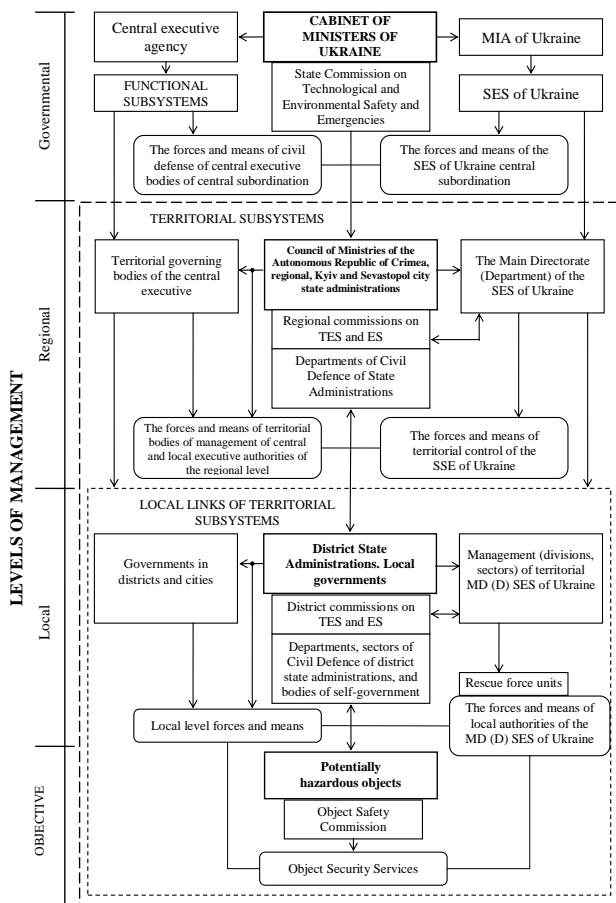


Fig. 5. Functional diagram of the Unified State System of Civil Defense operating in Ukraine (MIA of Ukraine – Ministry of Interior of Ukraine; SES of Ukraine – The State Emergency Service of Ukraine; Commissions on TES and ES – Commission on Technological and Environmental Safety and Emergencies; MD (D) SES of Ukraine – The Main Directorate (Department) of the State Emergency Service of Ukraine)

It is necessary to identify the main components of economic security, namely: financial (achieving the most efficient use of resources); political and legal (compliance with current legislation, comprehensive legal support of the legal activity of the enterprise); intellectual and personnel (preservation and development of intellectual potential, effective personnel management); technical and technological (the degree of compliance of the applied technologies with modern world analogues while optimizing resource costs); information (effective information and analytical support of economic activity); environmental (compliance with current environmental standards), as well as security (ensuring military and civil security) based on the results of the analysis of the interaction between the components of national security (see Fig. 1).

In Ukraine, in order to ensure the implementation of the state policy for the protection of the population, territories, the natural environment and property from emergency situations, the Unified State Civil Defense System (USSCD), which consists of functional and territorial subsystems (in accordance with the data of Fig. 5) operates. It should provide the necessary level of life safety through the prevention of natural, technological, social and military emergency, and the elimination of consequences, as well as assistance to the victims in peacetime and in a special period [42, 43].

The existing USSCD is aimed at solving the issues of ensuring the necessary level of territory life safety state only in the conditions when the emergency occurred. Moreover, the problem of implementation of the functions of monitoring and development of effective management decisions aimed at the prevention and localization of the ES, in the conditions of the origin dangers sources of different nature, remains completely open for the state.

#### IV. THE SCIENTIFIC AND TECHNICAL DIRECTIONS OF THE DEVELOPMENT PECULIARITIES OF THE FORMATION OF THE USSCD IN UKRAINE

The scientific and technical directions of the development peculiarities of the formation USSCD subsystems and the system ecological safety in the areas of monitoring, prevention, liquidation of emergency situations and minimization of their consequences are:

- on the territorial level:

- creation in the USSCD of the information-analytical subsystem of the management processes of prevention and localization of the emergency situations consequences, by including in vertical system from the object-state to the state level various functional elements of the territorial subsystem of monitoring emergency situations and the components subsystems of situational centers in the current system of USSCD s, are strongly connected with each other on information and executive levels for adopting appropriate anti-crisis solutions for solving various functional problems [44, 45];

- development of a subsystem for detecting and assessing the level of radiation situation to ensure life safety of the population in case of nature military emergency situations based on predicting the degree of radiation damage to the population according to the radiation factor [46];

- development of the subsystem forecasting the level of seismic activity of a local territory based on an

analysis of influence dynamics seismic activity on the surface of the globe on the level of local seismic activity territory in the open energetically dynamic system of Sun-Earth-Moon has been analyzed [47];

- development of the subsystem for operational monitoring of changes in the borders of the emergency zone, the level of danger, forecasting the emergence of new hazards, which is characterized by increased monitoring and forecasting the occurrence of new hazards. Also, automated unmanned aerial vehicles and ground-based hazard control devices are used together by delivering ground-based automated control devices to unmanned aerial vehicles in the emergency area [48];

- development of a subsystem to minimize the consequences of emergencies for the lower atmosphere based on modern methods of artificial precipitation, which consists of three main subsystems: monitoring, decision support and decision implementation. The monitoring subsystem includes three directions of data gathering: the registration of meteorological conditions in the areas of impression ES; precipitation, as well as the registration of hazardous factors. The decision support subsystem includes tools for predicting the development of the affected area and the intensity of neutralization of toxic ingredients in the atmosphere. The solution implementation subsystem can use chemical effects on precipitation and electrophysical methods [49];

- development of a subsystem for assessing the readiness of civil defense units for actions in emergency situations based on the accounting of complex indicators technical equipment of units and training of their personnel [50];

- at the object level: development of a subsystem for early detection of nature various ignition source and prevention of fire hazard occurrence at potentially hazardous objects with a large number of material resources and people, based on the use of acoustic emission method to control the parameters of the combustion reaction during the generation and development of fire hazard [51].

## V. CONCLUSION

An analysis of the economic conditions of the civil protection functioning and ecological safety systems of Ukraine and the conformity of their functions to the classical control circuit for the provision of: collection, processing and analysis of information; modeling the development of the situation at the object of management and development emergency in the territory of the city, region, country; development and adoption of management decisions on the prevention and liquidation of emergency situations, as well as minimization of their consequences has been carried out.

Based on these results, the scientific and technical areas developed by the authors on the development of the USSCD subsystems and the environmental safety system in the areas of monitoring, prevention, liquidation of emergency situations and minimization of their consequences have been presented.

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