

# Relevance of the integrated information management system as a subject of management of the national cyber security sector of Ukraine. The synergetic concept

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**Abstract.** The paper presents and solves the scientific problem of the study of relevance of the information technology – the Integrated Information Management System for the national cyber security sector. It highlights and presents the synergistic concept of substantiation of the relevance and need for the Integrated Information Management System in the national cyber security sector, due to its synergetic effect as a new level of development and perfection of the National Cyber Security System through the integration of the Integrated Management System into the comprehensive National Cyber Security System. It presents a generalized model of integration of the Information Management System of the national cyber security sector into the comprehensive structure of the National Cyber Security System.

## 1. Problem statement in general terms

The external circumstances make the National Cyber Security System get transformed and improved.

The state and its leadership have a need for:

1. *Models* (to see how and how to manage the national cyber security sector):
2. *The integrated information management systems* (to have an effective management tool).
3. *A powerful modernization shot* of the National Cyber Security System to face the challenges of time, the present-day needs, the modern technological development level, external risks and threats. That is, the change in the external and internal cyber-environment prompts Ukraine to make a strategic choice in favor of the integrated systems and models of management of the national cyber security sector.

## 2. Justification of relevance

The need for a fundamental change in the tactics of managing the national cyber security sector is obvious today. In our opinion, the main ways of solving this problem should be the development of a model and implementation of the Integrated Management System for the National Cyber Security Sector as a new effective mechanism for ensuring the proper level of management of the National Cyber Security System.

## 3. The research subject is closely linked with national needs

The subject of the presented research is quite topical on the national level, as it aims at improving the management of the National Cyber Security System by providing it with modern management tools.



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The information technology is such kind of a management tool that – the Integrated Information Management System in the national cyber security sector.

#### 4. Statement of the research purpose

The above problems have predetermined the purpose of our scientific examination.

The research purpose is to make the need for integration of Information Management System into the structure of the National Cyber Security System as a management subject more relevant; to present it as management object of the Integrated Management System.

#### 5. Analysis of the recent research and publications that initiated the problem solving process

The analysis of recent research and publications proves the growing need for development of IT, systems and models of the integrated management for the national cyber security sector.

Experts in the field of information security are aware of the views of foreign scientists and statements of foreign scientific and encyclopedic sources. So the Stanford Encyclopedia of Philosophy reads that models have an important representative value and are an instrument for identifying causal relationships [1].

The Ukrainian scientists O.M. Pupena, I.V. Elperin, I.M. Myagkykh, V.M. Dubovyi and O.V. Hlon worked on the conceptual issues of integrated systems and management model development [2; 3; 4].

The Ukrainian scientists V.V. Domariyev, V.L. Buryachok, V.B. Tolubko, V.O. Khoroshko, S.V. Toliupa et al, elaborated technical aspects of the cyber security [5].

A number of domestic and foreign scientists such as A.A. Kolesnikov, I.S. Dobronravova, V.I. Arshynov, V.G. Budanov, V.E. Wojciechowicz, T.V. Tereshchenko, E.N. Knyazeva, S.P. Kurdyumov, G. Hacken developed the synergetic theory of self-organization of the comprehensive systems [6; 7; 8; 9; 10].

However, the issue of ensuring the national cyber security management by establishing and implementing the Integrated Management Systems and Models still remains unclear.

#### 6. Methodologies of the research

Any research of systems and their models is impossible without modern scientific methods, approaches, and technologies of analytical researches.

The above-mentioned circumstances determine the necessity for carrying out this thorough research by applying a synergistic theory of self-organization of systems with a view to update the need for the creation, implementation and further exploitation of the Integrated Information Management System for the management of the comprehensive national cyber security system.

Within the synergy approach, a synergistic vision of the relevance of the Information Integrated Management System as the subject of management of the national cyber security system, which is used as the management object, will be considered.

Synergetics is a science that studies processes in unstable systems, the stages of transition from order to chaos and vice versa, from a stochastic state to a new stable state [9].

The German scientist G. Hacken, who introduced the term synergetics (*synergetikos* means a joint action in the ancient Greek), focusing on the coherent interaction of parts in the creation of the structure as a whole [8].

**The synergetic approach** took a special place among other approaches in this study, since it did not refute or abandon the principles of systemic, conceptual, functional and other methodological approaches that were used in this study when constructing the model of the Integrated Management System for the national cyber security sector, but supplemented and logically continued them.

**Synergistic knowledge and the ideas** have formed a synergistic vision for the consideration of the essence of the problem being developed, that is, the process of forming the Integrated Information Management System for the national cyber security sector;

This, in turn, make us use the **synergistic theory of** G. Haken in the process of constructing a generalized model of the integration of the Information Management System into the National Cyber

Security System:

- both as a qualitatively new methodological approach to the scientific knowledge of the essence of the problem being developed [6]; and
- as a research method, required to form the synergetic and ideological, synergetic and methodological knowledge and skills [10]; and
- as a methodology for designing and optimal reflecting modernization processes that took place at the stages of evolution of the National Cyber Security System as a comprehensive system, where the Information Management System will be integrated into the national cyber security sector [7].

**In this research, we use a synergistic approach from several perspectives.**

1. In the *theoretical* context, the synergetic method is used as a methodological basis:
  - for actualization of this research;
  - for the synergistic analysis of the integration of the Information Management System in the National Cyber Security System.
2. In the applied context, the synergetic theory of self-organization of the comprehensive systems is used as a synergetic mindset and as a methodological tool:
  - for realization of ideas of integration of the Information Management System into the structure of the National Cyber Security System with the aim of its development and improvement;
  - for formation of the synergetic approach to organization and phased management of the process of integration of the Information Management System into the structure of the National Cyber Security System.

As used herein, synergetic postulates will help to prove that at this stage of development, the actual factor in improving the comprehensive macro system of the national cyber security is the development of integration models of the Information Management System in the existing structure of National Cyber Security System.

## 7. Presentation of the main research body

At this stage of transformation of the National Cyber Security System as a comprehensive framework, a number of urgent requirements are put forward:

- regarding the ability to effectively use available resources, and structural and functional capabilities;
- regarding the actualization of activities in accordance with the level of modern technological development, time requirements, current challenges, and existing external threats;
- regarding capacity to reach the limits and even to exceed the possibilities of improvement by finding alternative ways of development (see Figure 2).

These tasks may be solved by the Integrated Information Management System of the national cyber security sector of Ukraine, a modern information technology and integrated management tool for comprehensive macro-systems, such as the National Cyber Security System and its components.

**Concerning the substantiation of relevance** of the model of the Information Management System integrated into a comprehensive National Cyber Security System, we may state the following:

1 An applied value of the Integrated Management Information System for the national cyber security sector *as information technology* is as follows:

- it *improves* organizational and functional structure of the National Cyber Security System;
- it *improves* the technical capacity of the National Cyber Security System;
- it *improves* management of the national cyber security sector;
- it *regulates* the informational and analytical providing of the National Cyber Security System;
- it *refines* the management tools of the National Cyber Security System;
- it *expands* management functions; *regulates* communication interconnections and information flows;
- it *provides* organizational and technical aspects of functioning of the National Cyber Security

System;

- it *takes into account* external influences and threats;
- it *supports* reliability and capacity of the National Cyber Security System; and so on.

2 An applied value of the Integrated Management Information System for the national cyber security sector **as a management tool** is as follows:

- it *provides* administration; reflects capacities of infrastructural elements;
- it *refers* to the target orientation;
- it *regulates* coordination all components of the National Cyber Security System;
- it *supports* all possible modes of functioning;
- it *targets* operations at specific results;
- it *develops, implements, maintains, regulates and improves* processes;
- it *establishes* the process-oriented management of the components of the National Cyber Security System;
- it *redistributes* flows of data, information and documents of the National Cyber Security System;
- it *establishes* functioning of all internal subsystems, information flows and interconnections between components and elements of the comprehensive system, the by National Cyber Security System belongs to.

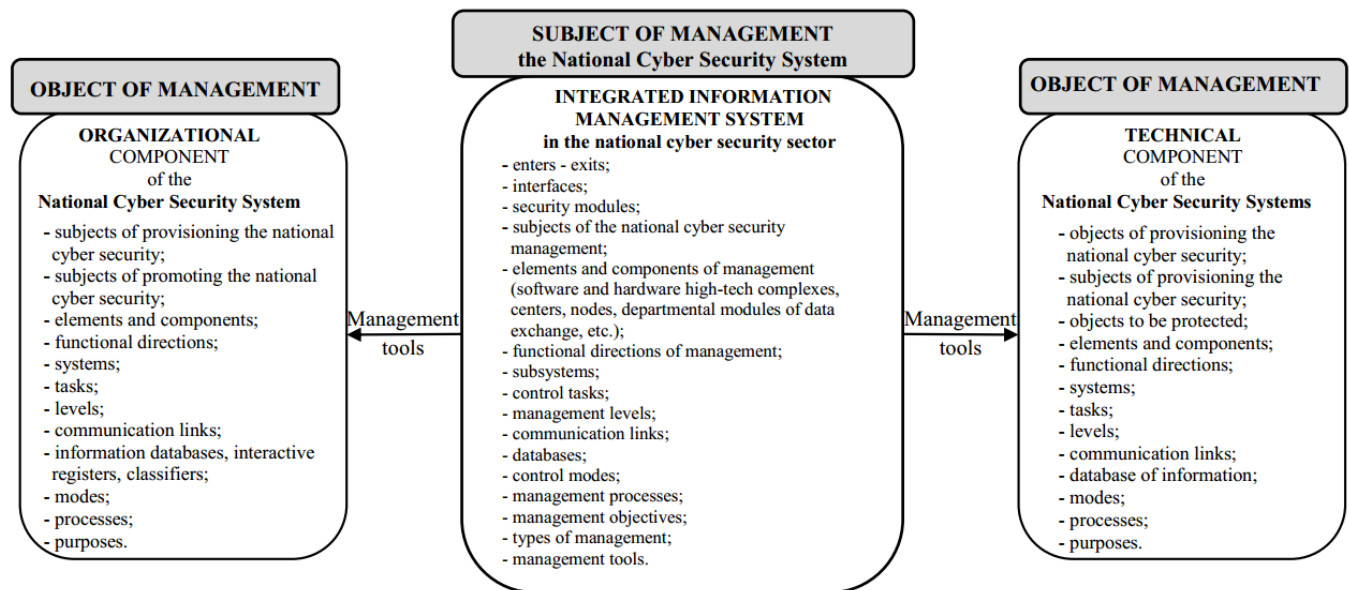
3 An applied value of the Integrated Management Information System for the national cyber security sector **for the needs of the state management** is as follows:

- it will solve the problem of absence of a flawless, efficient, reliable, sustainable, functionally capable system of management;
- it will meet all needs of the state management in the effective management tool;
- it will become a catalyst of the further intended (and not chaotic) improvement of the National Cyber Security System;
- it will unify all components of the National Cyber Security System;
- it will show: How? Who? Where? What tools are used to manage? What is the National Cyber Security System;
- it will cause a powerful modernization progress of the National Cyber Security System;
- it will provide the state leadership with the Integrated Information Management System for the national cyber security sector in order to face the modern challenges, the requirements of time, the external risks and threats.

Circumstances that have influenced the formation of synergetic vision of the Integrated Information Management System for the national cyber security sector are the requirements of time and processes of globalization, which make the state:

- be capable to protect its national cyber space;
- have at hand efficient and reliable tools to manage the whole National Cyber Security System, which would let it properly operate in different modes, circumstances, and in the presence of large-scale cyber incidents leading to massive disturbances in the regular regimes of the strategically important objects of the critical national infrastructure.

The generalized model of integration of the Information Management System of the national cyber security sector in the comprehensive National Cyber Security System is presented in Figure 1.



**Figure 1.** Generalized model of integration of the Information Management System in the national cyber security sector of the comprehensive National Cyber Security System

As seen from the presented figure, the process of integration of the Information Management System into a complex National Cyber Security System has a specific applied effect. It:

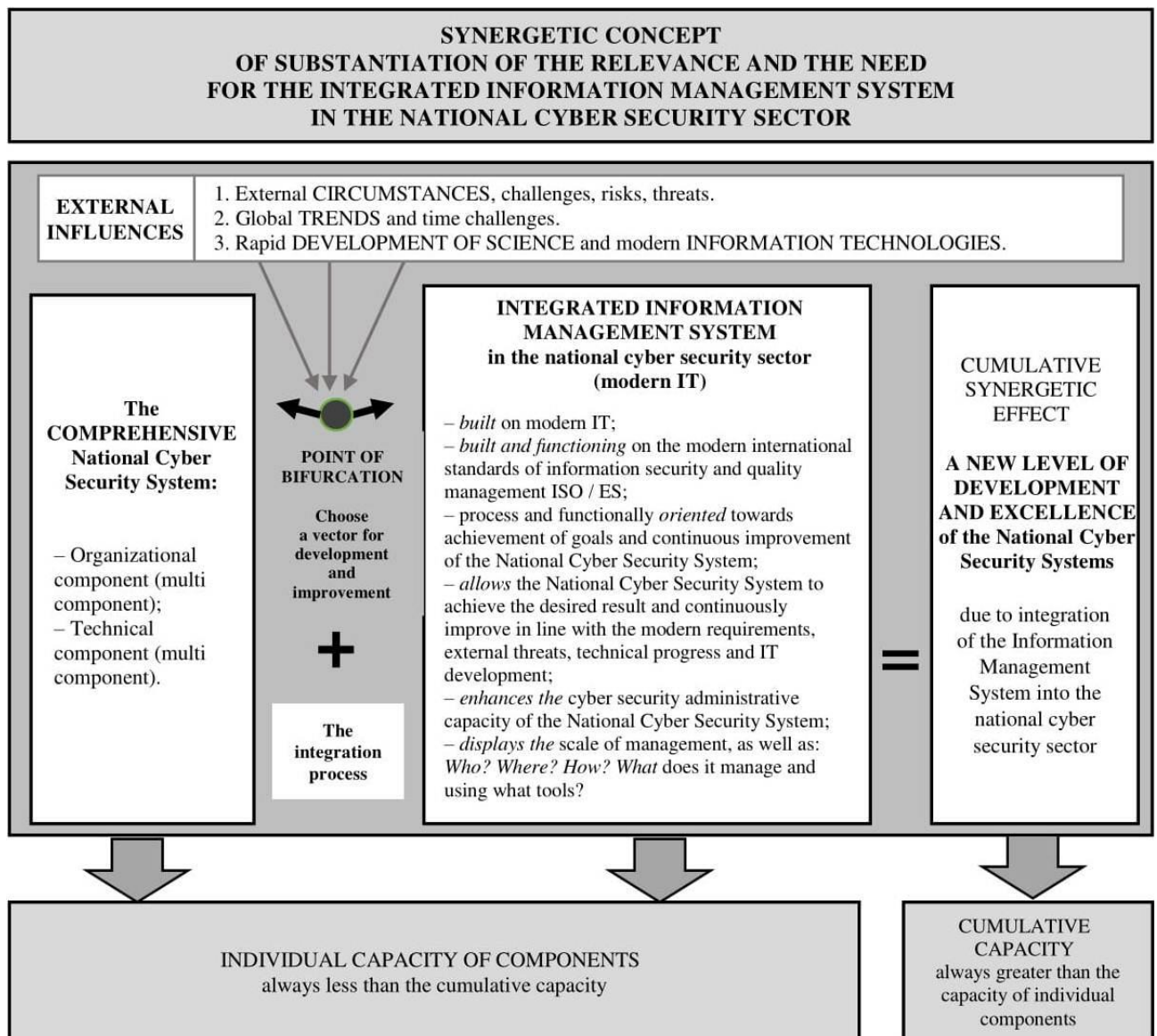
- *combines* various components within a single comprehensive macro-system;
- *causes a synergistic effect* due to the quantitative proportional effect of the potential of two components, such as the National Cyber Security System and the Integrated Information Management System;
- *upgrades* the structural, organizational and functional components of the National Cyber Security System;
- *forms* a basis for development and improvement of the National Cyber Security System;
- *improves* the general cyber security capacity of the National Cyber Security System;
- *causes the synergetic positive effect* from integration due to combining potentials of several components aimed at achieving the common goal.

Thus, *integration* has a positive effect, which is called the synergetic effect.

*Synergism* is an additional positive effect caused by: one-way action or purposeful action of individual components; or their incorporation and association of their group potential.

As used herein, the *synergistic effect* means that the action of two or more separate components exceeds the action and individual outcome of each individual component.

That is, the *synergetic effect* in our study means getting a positive result from the incorporation of the Information Management System (a subject of management) into the comprehensive structure of the National Cyber Security System Systems (an object of management). The synergetic concept of the relevance and needs in the Integrated Information Management System for the national cyber security sector is presented in Figure 2.



**Figure 2.** Synergetic concept of substantiation of the relevance and the need for the Integrated Information Management System in the national cyber security sector

## 8. Conclusions and results obtained

Taking into account the above, we consider it advisable to conclude that it is impossible to solve a number of cyber safety without solving problems of the proper management.

The research has showed that, by gradually developing and improving, the National Cyber Security System will search for and build new trends and ways of improvement.

The provision of the national cyber security in the current conditions of the interstate cyber wars is impossible without the use of the Integrated Information Management Systems and their models. The modern Integrated Information Management System is required to have an effective tool for ensuring proper management of the national cyber security sector.

Concerning the implementation of the synergetic principle for the study of the actual needs of the National Cyber Security System, one may say the following: by self-determining, the National Cyber Security System reflexes and gets a chance to reach a new level of development under the influence of external factors.

By creating and integrating the Information Management System into the structure of the National Cyber Security System, we create a new situation of the search and formation of the best synergistic way for further self-improvement of the structure and functional capacity of the National Cyber Security System.

The synergetic theory of organization of comprehensive systems allowed improving methodologically the significance of the self-development process of the National Cyber Security System by focusing on the possibilities of developing and implementing the Integrated Information Management System as a tool of self-organization, self-development, and self-improvement.

### 8.1. Prospects for further research

Further research should focus on:

- issues of developing conceptual aspects of the process-oriented functional model of the Integrated Information Management System in the national cyber security sector;
- issues of developing an integrated model of the Information Management System in the national cyber security sector;
- issues of developing mechanisms, algorithms, and processes for integrating this system into the National Cyber Security System;
- issues of developing *quantitative indicators* for assessing and analyzing the level of integration and integration index;
- issues of developing *qualitative indicators* for assessing and analyzing the level of excellence of the Integrated Information Management System in the national cyber security sector;
- issues of developing *effectiveness indicators* for assessing and analyzing the functional capacity of the Integrated Information Management System in the national cyber security sector;
- issues of developing *safety indicators* for assessing and analyzing the reliability and sustainability of the Integrated Information Management System in the national cyber security sector.

### 8.2. The main scientific outcome and the scientific value of the presented research

The paper contains elements of scientific research aimed at solving problems associated with the management of the National Cyber Security System. It elaborates the applied capacity of the Integrated Information Management System as a modern information technology to manage the national cyber security sector with the help of the modern, flawless management tool.

Later on, based on the present development, it would be possible to create and implement the Integrated Information Management Systems in similar comprehensive macro-systems of the military, defense or industrial complexes of the state.

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