

S U M M A R Y

The National Research Program "Information and Communication Technologies for a Digital Single Market in Science, Education and Security" (ICT in Science, Education and Security - ICTNOS) was implemented in the period November 2018 - November 2021 by three **leading organizations (BAS, Sofia University " St. Kliment Ohridski "and TU-Sofia) and 9 more universities (Prof. A. Zlatarov University Burgas, Plovdiv University, Plovdiv University, UCTM Sofia, University of Ruse, Shumen University, Medical University Sofia, UNIBIT, TU Varna, SWU)**

The program is structured in three scientific components:

- Electronic infrastructure for open science and open access to scientific results
- Digital technologies in education
- Information security

At the request of the Ministry of Education and Science, an additional task was included:

- Information system and register of programs for raising the qualification of pedagogical specialists

The topics of the program included:

- **High-performance and distributed calculations**
- **Computer modeling of problems and tasks**
- **Repositories for open scientific results**
- **Storage and analysis of large volumes of data**
- **Open educational resources**
- **Language and knowledge-based technologies**
- **Digital technologies in education**
- **Incident monitoring and prevention**
- **Information security training**
- **Development and auditing of secure systems**

During the three years of work on the program, the following main results were obtained:

- **Implemented joint research - each task is performed by several teams**
- **Strong reduction of fragmentation - 15 new scientific networks were created**
- **A critical mass of highly qualified scientists has been created to work on social issues - over 250 (over 120 women and over 130 men), at least seven Bulgarian scientists have returned to Bulgaria thanks to the program.**

- **Supporting the development of scientific capacity - over 350 scientific publications, about 240 in publications with impact factor and SJR**
- **Participation of Bulgarian scientists in European programs - at least 25 new participations in projects**
- **Attracting young scientists for research careers - nearly 100 young scientists attracted to work on the program**

ICTvNOS has contributed to expanding the participation of the Bulgarian scientific community in the European Research Area.

Bulgaria joined the European Open Science Cloud (EOSC) by building a Bulgarian portal as an integral part of it. Open access contributes to the development of science and faster and large-scale innovations, as it will allow in our country and will encourage the use of the European treasury of scientific achievements and opportunities for innovation.

The ICTNOS program adopts EU ideas, practices and policies and works to join the EOSC. Some significant concrete results:

- **An environment for high-performance calculations has been created and provided for use by all comers in Bulgaria - over 50 new certificates for use issued to research teams, 78 documented user tasks, fourteen user trainings**
- **A team from Sofia University is involved in <https://foldingathome.org/covid19/> - a global computational project whose main goal is to understand the way the coronavirus acts on cells and its ability to survive for a long time on surfaces.**
- **Problems related to antibiotic resistance that cause serious health problems have been studied.**
- **Purchased specialized equipment for 3D printing from RU is used primarily for the production of 3D printed safety helmets, which are donated free of charge to medical institutions and staff**
- **A framework for improving the cybersecurity of critical infrastructure has been developed.**
- **Information Security in Education and Practice, Cambridge Scholars Publishing, ISBN (13): 978-1-5275-6066-6**
- **Mathematical and computer models with application in practice - created and published over 30 models with specific application, in over 100 publications with impact factor and SJR**
- **More than 30 open courses and a huge number of open access training resources have been created.**
- **All results are published on the website of the program <https://npict.bg/> and will be constantly updated**

- **More than 80 three-dimensional models with application in education have been created, as well as more than 20 3D printed models for students with visual impairments**
- **Component 3 experts were involved in auditing the information security of electronic voting machines**
- **Established team for continuous threat analysis**
- **An information register of the approved training programs for raising the qualification of pedagogical specialists has been created and implemented, which provides management of the processes related to the publication and approval of programs for conducting qualification trainings of pedagogical specialists**

Teams within the program develop models, based on which daily analyzes and forecasts are provided to government agencies and society.

The society benefited from the following achievements in:

- the safety or toxicity of medicines;
- biodegradation in wastewater;
- prediction of immunogenicity of tumor antigens based on their primary structure;
- epidemiological models that can be applied to the theory of the spread of computer viruses.

More than 15 companies and organizations have been involved in joint work on the project, as well as the Mechatronics and Automation Cluster. A significant part of the work on the program was aimed at pooling the resources of the partners, coordinating and improving the work of the infrastructure and its joint use.

There is a large volume of activities, empathy with the problems of society and the state and assistance in solving them. Much has been done to achieve the set goals. But the needs of society and the state require the allocation of many resources and time for a longer period, and it cannot be expected that ICTNOS will solve them completely and definitively. Therefore, it is necessary for the state to periodically initiate such research programs in the field of ICT.

The Program has achieved much more and more significant results than it was intended. This is particularly evident in the implementation of the set indicators, each of which is significantly exceeded, including those related to the quality of scientific publications.

	Achieved indicators (common to the program)	Total	Plan
1.	Number of scientific publications with impact factor (IF) and / or impact rank (SJR)	244	60
2.	Number of developed 3D models	140	30

3.	Number of participations in scientific forums	199	30
4.	Number of events to promote the results obtained	117	6
5.	Number of young scientists	111	20
6.	Number of established international scientific networks	18	4
7.	Number of business partners	26	5
8.	Number of branch and other organizations	1723	3

The site (<https://npict.bg/bg/>) and the reports of the program abound with Internet addresses where the results of the work on the Program have been uploaded. This is the modern way of communication and the best way to disseminate the results of ICTvNOS in society.