REVIEW

from Prof. Stefka Fidanova – IIKT-BAS
to

PhD thesis
for obtaining an educational and scientific degree
"Doctor"
in professional field 4.6 "Informatics and Computer Science"
doctoral program "Informatics"
on the topic: "Modeling and automation of standardized information security management systems"
by Todor Velev Velev

By Order No. 232 dated 01.10.2025 of the Director of Institute of Information and Communication Technologies at Bulgarian Academy of Sciences, Prof. Svetozar Margenov, pursuant to Art. 4, para. 2 of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB) and decision of the Scientific Council of IICT-BAS (Minutes No. 7 of 24.07.2025) I have been appointed a member of the scientific jury under the procedure for obtaining the educational and scientific degree "doctor" in professional field 4.6 "Informatics and Computer Science", doctoral program "Informatics" by Todor Velev Velev witht PhD thesis on the topic "Modeling and automation of standardized information security management systems".

According to Law on the Development of Academic Staff in the Republic of Bulgaria, the rules for its implementation and the specific requirements introduced in the regulations of IICT-BAS, applicants must meet the following requirements:

1. The PhD thesis must contain scientific or scientific-applied results that represent an original contribution to science. The tesis must show that the candidate has in-depth theoretical knowledge in the relevant specialty and abilities for independent research.

2. The PhD thesis must be presented in a form and volume corresponding to the specific requirements of the primary unit. The thesis must contain: title page; content; introduction; exposition; conclusion - summary of the results obtained with a declaration of originality; bibliography.

According to Low and rules for its implementation and the specific requirements introduced in the regulations of IICT-BAS, applicants must meet the following requirements:

Група показатели	Съдържание	Брой точки
А	Показател 1	50
Г	Сума от показатели от 5 до 10	30

The PhD student is supervised by Prof. Nina Dobrinkova.

Actuality

Digitalization is increasingly entering modern society. Nowadays, it is unthinkable to imagine our daily lives without the exchange of digital data. These processes are associated with the growth of network-connected devices including individual, corporate and public communication platforms. Virtually all sectors of the economy use the exchange of digital data, such as finance, e-commerce, logistics, personal and corporate data management, and others. In parallel, there is an increase in connectivity and diversification of communication channels. For this reason, information security is of great importance. This requires the development and implementation of automated platforms with an element of artificial intelligence that can analyze information flows and their interaction.

The relevance of the topic of the dissertation stems from the need of the modern information society for secure information connectivity.

The object of research of my dissertation is standardized information security management systems (ISMS) and the possibilities for automation of functionalities and their management.

The subject of research is a Model of a software product, a complex Platform, that can model and automate any information security management system, built in accordance with an internationally recognized standard or standards in this field.

The object and subject of the research determine the goals set for the dissertation.

Dissertation objectives

The aim of the dissertation is to develop and present a platform model for the automatic management of standardized information security management systems.

To achieve this goal, the following tasks have been formulated:

- Research and analysis of the theoretical foundations of standardized information security management systems in aspects:
  - Information security;
  - Information security standards;
  - Information Security Management Systems (ISMS);
  - Software applications for IS.
- Analysis of the processes, requirements and characteristics of the platform for management and automation of standardized information security management systems. The task is divided in accordance with the specified methodology into the following subtasks:
  - Research and analysis of work processes subject to automation and their corresponding information flows;
  - Determining the functional and non-functional requirements of the platform through research and analysis of data, user groups and information security standards;
  - Identifying the general characteristics of the system.
- Design of an optimal platform model for modeling and automation of standardized information security management systems and associated architecture.

Структура на дисертацията

The dissertation is 188 pages long and contains 80 cited sources. It consists of an introduction, three chapters, a conclusion and appendices.

The Introduction emphasizes the relevance of the problem, presents the methodological parameters of the dissertation, its structure, object, goals and objectives for their achievement.

The first chapter provides a theoretical analysis of the foundations on which the model of the Platform for Management and Automation of Standardized Information Security Management Systems is built. The terminology and aspects of information security, methods, technologies and tools for information protection and the challenges provoking the study are defined. Information security standards are analyzed, as well as the terminology, essence and goals of standardization. The

main elements, architecture and processes for the development and implementation of Information Security Management Systems (ISMS), as well as the types and functional scope of software products related to the management of the ISMS are studied.

The second chapter presents a methodology for researching and modeling an automated standardized information security management platform and, in accordance with it, an analysis of the processes, definition of requirements and identification of the general characteristics of the system are carried out. The standardized work processes that the platform automates and the corresponding information flows are studied. The functional and non-functional requirements are defined based on an analysis of the data, user groups and information security standards. The general characteristics of the platform are determined by studying good practices for user behavior, productivity, security and administration of information systems. The unified modeling language – UML™ and the Business Process Model and Notation (BPMN) standard for visual modeling of business processes in the form of diagrams are used.

In the third chapter, a theory of a document matrix is developed as a basis for operational management of an organization and a company. The modeling methodology and the conceptual model of the Platform are described. An optimized model has been developed in accordance with the theoretical foundations and the research and analyses carried out in the previous chapters. A logical and physical architecture for the implementation of the platform is proposed.

The applications present basic terminology, data exploration, UML model code, and model and database implementation with SQL Alchemy and Python.

Knowing the status of the problem

The overall presentation shows a thorough knowledge and understanding of the topic of the dissertation. There is no doubt that the dissertation candidate has entered the scientific issue very well. The list of cited scientific sources is up-to-date - sources from the last 10 years are 30% of the total, with 22% from the last 5 years. On the other hand, it also contains older, but important publications for the field. The dissertation candidate's knowledge of the field is very well illustrated by Chapter 1, which analyzes the theoretical foundations underlying the developed platform. It also examines the currently existing platforms with their advantages and disadvantages.

Research methodology

The methodology for conducting the research, chosen by the dissertation candidate, stems from the set goals and corresponds to the tasks arising from these goals. The topic of the dissertation requires the application of an interdisciplinary approach when conducting the research, therefore the following methods were used to fulfill the research tasks:

- At the theoretical level: bibliographic; comparative; descriptive;
- At the empirical level: heuristic; analysis, synthesis, generalization; modeling.
  A software implementation has been developed.

Contributions

The contributions in the dissertation can be divided into scientific and applied scientific contributions.

The main scientific contributions are:

- An algorithm and methodology for research and modeling of an automated standardized information security management platform are proposed;
- A document matrix theory has been developed as a basis for operational management of an organization and company.

The main applied contributions are:

- An analysis of information security management systems has been made in the following aspects: Information security; Information security standards; Information security management systems (ISMS); IS software applications;
- Work processes and flows that are subject to automation through the developed platform have been identified, defined and analyzed;
- Functional and non-functional requirements are defined after research and analysis of data, user groups and information security standards;
- The general characteristics of the system are identified, using heuristic methods;
- A model of a complex platform for modeling and automation of standardized information security management systems has been developed. The model is based on monitoring, analysis and management of the document matrix, workflows and information flows and assets of the organization;
- A platform architecture has been developed that is in line with modern requirements for modularity, automation, and standards compatibility

The achieved results provide an opportunity to continue research in the following areas:

- Development of the Platform with integration with artificial intelligence, which analyzes: Information units and records; System, program and communication logs; Information generated by control criteria;
- Based on the analyses performed with AI, the platform's functionalities can be further developed in aspects: Offering optimization of the SUS; Displaying abnormal parameters and activities outside the norm; Calculating probabilistic events and predicting risk factors;
- The generative unsupervised neural network - Boltzmann Machine (Boltzmann Machine) uses techniques on input data to analyze the normal states of the ISMS to predict undesirable situations. Internationally recognized standards define a set of security controls for monitoring, auditing and managing the ISMS. They are divided into categories and each of them has standardized attributes. The neural units of the Boltzmann machine are based on the ISMS security control infrastructure;
- Integrating neural networks into an ISMS can significantly improve an organization's ability to detect, predict, and respond to security anomalies. NNs are widely used in almost all areas of information and cybersecurity, but for modeling the behavior of an ISMS as a complete complex system, they are an innovative method for reducing costs and time, as well as preventing or mitigating damage.

Assessment of the dissertation candidate's publications

The results obtained in the dissertation have been reported at three international conferences and published in the volumes of proceedings of these conferences. The volumes have been published in prestigious scientific publishers and are visible in Scopus.

Todor Velev has participated in two scientific projects, with part of the results of his dissertation being related to his work on the projects. The doctoral student was also on a long-term visit to Solent University Southampton, UK under the Erasmus+ program.

Abstract

Overall, the abstract correctly reflects the content of the dissertation.

Critical notes

I have no significant critical remarks. I noticed a lack of year of publication in several of the literary sources. In places there is use of foreign words that could be replaced with their Bulgarian counterparts. All these are notes of a technical nature and do not diminish the significance of the achieved results.

Significance of the development for science and practice

The work done by the dissertation is sufficient in terms of volume and depth of the research. There is no doubt about the practical focus of the developments made and the results obtained, as well as the need for work in this direction. In this sense, I find the work significant both scientifically and practically.

Personal opinion

I know the dissertation candidate only vaguely, but I know my colleagues from Solent University Southampton, UK, well. They highly appreciated Todor Velev's work during his stay at their university under the Erasmus+ program. Overall, the dissertation is well written and structured. The goals and objectives for their achievement are clearly set. The contributions are given briefly and concisely and to the point. The dissertation candidate has one independent publication, which is a guarantee that his personal contribution to achieving the results in the dissertation is significant. This also shows that he can work independently and is well-established as a scientist.

Conclusion

As a consequence of the above, it can be stated that all the requirements of the Law on the Development of Academic Staff , the Regulations for its implementation and the Regulations on the terms and conditions for obtaining scientific degrees and occupying academic positions at IICT-BAS. I can say that the level of this dissertation and the publications related to it significantly exceeds the minimum requirements.

The critical remarks I have given do not diminish the significance of the results obtained and the scientific value of the work provided to me.

All this gives me grounds for a positive assessment and I propose to the esteemed Scientific Jury to award the educational and scientific degree "Doctor" in professional field 4.6 "Informatics and Computer Science" to Todor Velev Velev.

20.10.2025
Sofia

На основание
ЗЗЛД