



REVIEW

by Acad. Ivan P. Popchev - BAS

of dissertation work for acquiring the educational and scientific degree

"Doctor"

in professional direction 4.6 "Informatics and Computer Science"

Doctoral program "Informatics"

Titled "Methods, Algorithms and Software Systems for Decision Support"

by Boris Atanasov Staykov

By Order No. 112/09.06.2020 of the Prof. G. Angelova, DSc - Director of IICT - BAS in accordance with Art. 4, para. 2 of the Act of Development of the Academic Personnel of the Republic of Bulgaria (ADAPRB) and with a decision of the Academic Council of IICT (rec. of proceedings No. 5 from 09.06.2020) for awarding of educational and scientific degree "doctor" in professional direction 4.6 Informatics and Computer Science, doctoral program "Informatics" by Boris Atanasov Staykov of dissertation work Titled " Methods, Algorithms and Software Systems for Decision Support" I have been appointed a member of the Scientific Jury.

When assessing the dissertation work, the terms ADAPRB, RAADAPRB (Decree No. 26 of 13 February 2019) and the Rules for specific requirements of IICT for the application of the law and therefore will be accurately delivered:

1. According to Art. 27 (1) of ADAPRB "the dissertation work shall contain scientific or applied research results that represent an original contribution to science. The dissertation shall show that the candidate has profound theoretical knowledge in the respective subject, as well as their abilities of independent scientific research."
2. According to Art. 27 (2) of ADAPRB the dissertation work should be presented in a form and volume corresponding to the specific requirements of the primary unit. The dissertation work should contain: title page; contents; introduction; presentation; conclusion - summary of the obtained results, accompanied by declaration of originality; bibliography.

According to RAADAPRB, the minimum required number of points by groups of indicators for "Doctor" are:

Group of indicators	Contents	Number of points
A	Indicator 1	50
G	Sum of indicators from 5 to 10	30

The scientific supervisor of the dissertation is Prof. Vasil Vassilev, PhD and scientific advisor is assoc. Prof. Tatyana Atanasova, PhD.

The aim of the dissertation is "engineering and developing decision support systems, based on certain methods for solving different classes of multicriteria optimization problems." (p. 52)

To achieve this aim, the **following tasks** need to be fulfilled:

- Choosing methods for multicriteria optimization problems, which will be used as a base for the developed decision support systems.
- Algorithmic and software implementation of the chosen methods. This will be for the main core of the developed systems.
- Developing a syntax for defining problems for multicriteria optimization and its software implementation for the purpose of the developed system.
- Creating decision support system that works under WINDOWS operating system.
- Creating web-based decision support system.
- Developing of communication modules for electronic data exchange with third party systems.

The dissertation is in volume of 174 pages, 43 figures, 16 tables and includes:

- Introduction (3 – 52);
- Classification – oriented scalarizing problems and algorithms (**Chapter 1**, 53 - 78);
- Software system MKO – 2.1 (**Chapter 2**, 79 - 99);
- Software system WebOptim (**Chapter 3**, 101 - 128);
- Experimental Research – Solving the Problem of Operational Planning Using Multicriteria Optimization (**Chapter 4**, 129 - 145);

- Conclusion (146 - 147);
- Publications on the topic of the dissertation (148 - 149);
- Citations (150 – 151);
- Summary of results achieved (152)
- Declaration of originality of results (153);
- Acknowledgments (154)
- Bibliography (155 - 174).

Eight publications published in the period 2006 - 2019 are on dissertation:

- **1 publication is a chapter from book (No. 2);**
- 2 publications are in **journals SJR Q3** (NNo. 3 and 4);
- 3 publications are in **journals** (NNo. 1, 5 and 8);
- 2 publications are in conference proceedings (NNo. 6 and 7);

The **3 citations** of publication No. 7, **7 citations** of publication No. 6 and **1 citation** of publication No. 1 have been noted.

The requirements of the RAADAPRB and specific requirements of IICT-BAS **are fulfilled.**

The obtained **results** briefly can be systematized as follows:

- A syntax and corresponding software parser have been developed for defining linear and linear-integrated problems for multicriteria optimization.
- The MKO – 2.1 system have been designed and developed for operating under WINDOWS operating system.
- The web-based system WebOptim have been designed and implemented, and communication modules for electronic exchange have been developed.
- Experimental studies have been conducted of the developed systems.

Critical notes:

1. The bibliography does not include the dissertation publications. The publications of Boris Staykov in the bibliography are missing from the list of dissertation publications (p. 148).

2. The title of the dissertation is "Methods, ... " according to the aim and tasks it is not supposed to create methods, but only "choice of methods" (p. 52) and in the obtained results it is written "many methods are systematized" (p. 152).

In the **Introduction**: point 2.2 methods for solving problems for multicriteria analysis there is a record only for "two basic models" [Clemen, (1996)]; point 3.2 Methods for Solving Multicriteria Optimization Problems records only for "two main approaches" approach [Miettinen (1999)] and... [Ehrigon and Wiecek (2004)].

Therefore, neither methods are chosen (p. 52) nor many methods are systematized (p. 152), but only models (p. 13) and approaches are given (p. 22), which in principle does not imply the inclusion in the title of "Methods".

3. On page 17 there is a text "In 2009 the Bulgarian trace is left by the research of the methods and algorithms for the so-called group decision making", which text is strange.
4. On pages 53 and 73 is the "GEN-IM method" marked, and on page 74 in the generalized interactive algorithm called GEN-IM? Algorithm or method?
5. There are no guidelines for future research as a consequence of the results obtained in the dissertation.
6. The abstract in English needs editing.

Questions on the dissertation work:

1. Isn't what is written in the Introduction to WWW technology "the most convenient way to present a detailed platform to be used mainly by non-specialists in the field" (p. 9) a strong limitation of possibilities?
2. Why for MCO - 2.1 (Chapter III), except for publications NNo. 7 (2007) and 8 (2006) do not cite other sources?
3. Is the development of MCO-2.1 suppose after rewriting by Mr. Petar Zhivkov of the C# calculation module for use in WebOptim?
4. Under modern conditions, is the computing power of the machine on which it is installed still a disadvantage of MCO - 2.1? (p. 147).
5. As a university system, what are the capabilities and limitations of NiMBUS? Why was this system chosen and with whom exactly was it compared? Examples?
6. What does "most meaningful alternative" mean in the context of the task? (page 144)

7. Can the place of MCO-2.1 and WebOptim be determined in the huge variety of real DMSS?
8. Is it possible that MCO - 2.1 and / or WebOptim to be a commercial product on the software tools market?
9. What development of software systems for decision support could be predicted in the situation of new technologies, methods and risks of industry 4.0?

The **Abstracts** in Bulgarian and English are in volume 34 pages, and present the thesis.

CONCLUSION

The dissertation work fulfills the requirements of ADAPRB, RAADAPRB and the specific requirements in IICT-BAS.

I give a **positive conclusion** for acquiring the educational and scientific degree "**Doctor**" to **Boris Atanasov Staykov**.

I propose to the Scientific Jury to unanimously vote for **Boris Atanasov Staykov** the educational and scientific degree "**Doctor**" on 4.6. Informatics and computer sciences, doctoral program "**Informatics**".

23.06.2020

Signature: ..

**NOT FOR
PUBLIC RELEASE**

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