OPINION

by Assoc. Prof. Irina A. Radeva, PhD
Institute of Information and Communication Technologies - BAS
for a dissertation thesis for awarding the educational and scientific degree **"Doctor"**
in professional direction **4.6 "Informatics and Computer Science"**
doctoral program " Informatics "

Titled "***Models and methods for portfolio Optimizing and management using time series***"

by Krassimira Doneva Stoyanova- Chokova

By order No. 66/03.23.2020 and No. 96/19.05.2020 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. 2/23.03.2020) for awarding of educational and scientific degree "doctor" in professional direction 4.6 Informatics and Computer Science, doctoral program "Informatics" by Krassimira Doneva Stoyanova- Chokova with dissertation thesis "Models and Methods for Optimizing and Management Portfolio using Time Series" I have been appointed a member of the Scientific Jury.

As a member of the Scientific Jury I received:
1. Order No. 66 / 23.03.2020 of the Prof. G. Angelova, DSc - Director of IICT - BAS in accordance with Art. 4, para. 2 of the Law for development of the academic staff in the Republic of Bulgaria and with a decision of the Scientific Council of IICT (protocol No. 3/23.03.2020) and Order No. 96/19.05.2020   as   amended of Order No. 66 / 23.03.2020 of the Prof. G. Angelova, DSc - Director of IICT - BAS.
2. Dissertation thesis for awarding the educational and scientific degree "Doctor".
3. Abstract and in Bulgarian and English.
4. Copies of the publications on dissertation thesis.
5. Information for meeting minimum requirements of IICT - BAS.

When evaluating the dissertation, the terms of ADAPRB, RAADAPRB (Decree No. 26 of 13 February 2019) and the Rules for specific requirements of IICT for the application of the law are decisive.
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.

The scientific supervisor of the dissertation thesis is Assoc. Prof. Vasil Gulyashki, PhD.

Dissertation thesis is in a volume of 130 p., 17 figures, 22 tables and includes: introduction, three chapters, conclusion, contributions, publications on the dissertation thesis, declaration for originality of the results, bibliography of 253 source and three appendixes.

The aim of the dissertation is "to propose models and methods/algorithms for portfolio optimization using time series in the financial field." To achieve this goal the **following tasks** are set:

- To review the existing evolutionary single-criteria and multi-criteria algorithms for portfolio optimization.
- To propose a model for portfolio optimization, which guarantees certain properties of the portfolio.
- To propose an approach/methodology for portfolio optimization using time series.
- To propose an algorithm for optimization and portfolio management with given criterion/(criteria), which is sufficiently accurate and fast.
- To conduct numerical experiments to test the performance of the proposed models and algorithms.
- To develop a toolkit of program modules in MATLAB, allowing the implementation of the above tasks.

The formulated aim and tasks have scientific and scientific-applicational potential for research and application in the field of financial investments within the classical formulations and approaches to the problem of management of securities portfolios.

7 publications are presented on dissertation thesis: 1 book chapter, 1 journal publication, SJR = 0.125, Q3, 5 publications in conference proceedings, all in co-authorship. The presented publications give grounds to assume that the dissertation thesis has the necessary publicity. No citations noticed.

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

- Formulated a model for portfolio optimization for several periods, which is a modification of the model of the Average Variation (MV) of Harry Markovic.
- Formulated hybrid evolutionary algorithm based on X. S. Yang's fireflies' method and R. Hook's and T. A. Jeeve's Pattern search method.
- Formulated tasks solved by the proposed hybrid algorithm and using the standard solvers *fmincom* of MATLAB (*Interior point*).
- Developed software modules for the proposed Hybrid evolutionary algorithm implementation.

It can be assumed that the presented results sufficiently cover the scope of the set goals and objectives.

Questions on the dissertation thesis:

1. One of the tasks is to "propose a portfolio optimization model that guarantees certain portfolio properties". What are the "defined portfolio properties" other than risk and return that the proposed model was supposed to guarantee?

2. How does the proposed approach/methodology for portfolio optimization using time series, in the contributions called "generalized methodology for portfolio formation" differ from the classically proposed in theory or applied in practice approaches/methodologies?

3. What will be the comment on the inclusion in the portfolio of an asset with a negative interest rate and are there any assumptions on how this will affect the final return of the portfolio for the investment horizon of the investment?

4. To what extent, in the opinion of the author of the dissertation, the proposed hybrid model is subject to improvement in terms of application in a crisis, when not the return but the preservation of the value of assets in the portfolio would be the main criterion?

In dissertation work some technical remarks can be made, for example with the title of the concluding part, which should be "Conclusion - summary of the obtained results", some incompleteness in records of sources in the bibliography and certain inaccuracies in the traditionally accepted terminology on the topic in Bulgarian and English.

The Abstracts in Bulgarian and English are in volume of 30 pp., and present the thesis.

C O N C L U S I O N

I accept that the **dissertation thesis meets the requirements** of ADAPRB, RAADAPRB and the specific requirements in IICT-BAS and **give a positive opinion for rewarding the educational and scientific degree "Doctor" of Krassimira Doneva Stoyanova-Chokova. I propose to the respected Scientific Jury to vote for Krassimira Doneva Stoyanova-Chokova the educational and scientific degree "Doctor" in professional direction 4.6. "Informatics and Computer Science", doctoral program "Informatics".**

24.06.2020

Signature: ...

Assoc. Prof. Irina Radeva, PhD