REVIEW

by **Prof. Maria Petkova Hristova**, **PhD**
professional field 4.6 Informatics and Computer Science,
on a dissertation for the acquisition of an educational and scientific degree
"Doctor of Philosophy" in professional field 4.6. Informatics and Computer Science,
scientific specialty "Informatics"
Title of the dissertation: **Analytics in IT Projects**
Author of the dissertation: **Penko Zhelev Ivanov**
Scientific supervisors:
Assoc. Prof. Vladimir Zlatev, PhD, Boston University, Metropolitan College, USA
Assoc. Prof. Dr. Petya Assenova, PhD, New Bulgarian University

1. General description of the submitted materials and the PhD student

The review is prepared according to order № Z-PK-295/10.07.2024 of the Rector of New Bulgarian University Prof. D.Sc Plamen Doynov, by which I am appointed as a member of the scientific jury for the defense of the dissertation of the PhD student Penko Zhelev Ivanov for the acquisition of educational and scientific degree "PhD" in the professional field 4.6. Informatics and Computer Science, and at the first meeting of the scientific jury I was selected as a reviewer.

As a member of the scientific jury I received:

- CV of the PhD student (in English);
- dissertation in English;
- abstract of the dissertation (in Bulgarian and English);
- author's reference for published results of the dissertation research;
- list of publications related to the dissertation research;
- declaration of originality and authenticity of the attached documents.

Penko Ivanov holds a Bachelor's degree in Business Administration - Management and Entrepreneurship from New Bulgarian University (NBU) and a Master's degree in Information Technology Project Management - a joint program of the Institute of Mathematics and Informatics of BAS and NBU. Since 2015 he is a full-time PhD student at NBU, Master's Faculty, Department of Informatics, in 4.6 Informatics and Computer Science", PhD program "Informatics". He has extensive experience in IT services, digital product management and marketing, solution sales, solution design, software development, business analysis and project management.

He holds certifications in IIBA-CBDA certification preparation, Project Management Professional (PMP), Certified Business Analysis Professional (CBAP) and PMI Professional in Business Analysis (PMI-PBA). He has worked for Konica Minolta, Kontrax, GfK and currently for the Financial Times (FT). He teaches at NBU in graduate courses in IT project management, business analysis and data mining for business analytics. He has been a guest lecturer at York University and Boston University's Metropolitan College (MET), USA. He was awarded the Best Student Research Paper at the 11th International Conference on Computer Science and Education in Computer Science (CSECS), Boston, MA, USA, 2015.

2. Relevance of the problem developed in the dissertation in scientific and applied aspect

The main focus of the dissertation work of PhD student Penko Ivanov is on the study of the possibilities of integrating applied analytical approaches to optimize project management in the field of information technology, as well as the training of future specialists in this field. This is undoubtedly a very popular topic in the field of computer science, in particular - IT project management. The relevance is determined by the dynamically changing business environment associated with the increasing complexity of IT projects in the era of big data, when information analysis and interpretation are becoming key factors for competitiveness in every sector of the economy.

The author presents work situated in a rapidly developing new interdisciplinary frontier between business and IT. Business analytics through artificial intelligence is a rapidly developing concept in the IT sector that is gaining increasing importance and popularity worldwide and in our country, especially in the context of accelerated business growth in the IT sector. This concept also plays a strategic innovative role for more efficient management of IT companies, better productivity and competitiveness. Therefore, a dissertation dedicated to this thematic area is undoubtedly relevant.

The relevance of the topic is also defined by the specificity of professional and scientific analytics in IT projects. This activity requires highly qualified specialists with management experience in IT organizations who combine knowledge in both areas - business and IT.

All this determines the importance of the dissertation both in theoretical and practical-applied aspects.

The goal of this dissertation is stated as: to develop and validate frameworks that facilitate the successful integration of analytics into IT project management and enhance education in this field. In order to achieve the objective, 4 main tasks are defined:

1.Conduct a critical analysis of existing methodologies and standards for integrating analytics into IT projects.

2.Propose a methodological framework that effectively incorporates analytics into IT project management processes, aligned with leading industry standards.

3.Develop an educational framework that addresses the growing demand for professionals with practical skills in applied business analytics.

4.Validate the proposed frameworks through their application in real-world IT projects and educational programs.

3. Degree of knowledge of the state of the problem and creative interpretation of the literary material

From the dissertation and its bibliography it can be concluded that the doctoral candidate has thoroughly and carefully studied numerous research papers in the field. The bibliography contains 149 literature and internet sources in English, all correctly cited in the text. The literature review, analysis and conclusions testify to the doctoral student's excellent knowledge of the theoretical and applied aspects of the current developments in the field.

It should also be noted that Penko Ivanov's extensive professional experience of over 20 years in IT project management and business analysis, as well as his nine years of teaching

experience at NBU, help him to be adequate in researching and solving problems of the subject area. His job is closely related to the research topic.

4. Conformity of the chosen research methodology with the stated aim and objectives of the dissertation

The research methodology used to achieve the aim of the dissertation is appropriate. The scientific methods applied are appropriate for a scientific and applied research: systematic literature review and case studies of recent projects in leading international organizations, methods of systematic collection, comparative analysis, synthesis and validation of information. Real business cases and case studies are used to test the effectiveness and applicability of the developed methodological and educational frameworks, critical analysis of results, etc. All this contributed for achieving the main objective and fulfillig the set tasks of the research, which is evidenced by the presented results.

5. Characteristics and evaluation of the thesis

An authentic and interesting dissertation is presented, written in English under the title "Analytics in IT Projects". The author explicitly emphasizes the fruitful collaboration with teams from NBU and Metropolitan College of Boston University in his long-standing work on the topic and guarantees the originality of the work. Adding to this the scholarly style of the exposition, the exquisite verbosity and clear expression, the work can be considered a valuable contribution to the PhD space of computer science.

Logically sequenced according to the chosen research methodology, the dissertation is structured in nine chapters, including an introduction, conclusion and recommendations, directions for future development and a bibliography. The dissertation consists of 298 pages of main text and three appendices of 29 pages. The graphical part consists of 80 figures, 12 tables and 8 code samples.

In the introduction the problem statement is made and the motivation of the PhD student is justified. The aim, objectives and scope of the dissertation research are clearly and correctly stated. It is concluded that the integration of robust analytical frameworks into IT project management and curricula is essential to meet the demands of a data-driven world. It highlights the role of methodological and educational frameworks in overcoming common challenges in big data IT projects, improving IT project outcomes and preparing professionals in modern IT environments.

A merit of the work, tending towards an original contribution, is the scientific set-up and systematic organization of the search and study of the literature sources related to the dissertation (chapter two). A comprehensive and unbiased coverage of the research topic has been sought, but the space explored has been properly narrowed in accordance with the tasks, frames and areas of search by setting criteria for the selection of information sources. Using modern tools, the doctoral student searches the vast ocean of the written word, but not arbitrarily by thematic proximity to the dissertation, but purposefully determines what interests him: "academic research", "industry standards", "leading international scientific and business organizations", "practice guides", etc. These are materials with selected highlights: publications with significant contributions, innovative solutions and recommendations for future research. The sources cited are extracted using this methodology and are thoroughly analyzed in 80 pages of text.

Another undoubted quality of the work is the special attention to research methodology, to which Chapter Three is devoted: data collection methods, data analysis techniques, research limitations and ethical considerations. A critical assessment of existing knowledge in the area of applied analysis in IT projects is made. Very importantly, the gap between theory and practice on the topic is identified with the typical gaps and challenges. In addition to being a traditional structural element of the thesis, the literature review and its results thus become foundational for the tasks and research in the following chapters of the thesis, which gives grounds to state that the PhD student emerges as a good researcher who can conduct concrete practical research, generalize it and draw conclusions for practice.

Chapter four is dedicated to solving the problem of "Developing the methodological framework for analytics in IT projects". The context and relevance of the methodology as well as the purpose of the developed framework are described in detail. It is organized in a hierarchical structure and covers a cycle of eight key phases from project initiation and data management to analytics modeling, deployment, and continuous improvement and innovation. Specific tools, technologies, and analytical techniques included to enhance its effectiveness and applicability are presented. The framework is aligned with best practices and industry standards established by leading organizations such as the International Institute for Business Analysis (IIBA) and the Project Management Institute (PMI), ensuring its applicability and relevance. The strategic advantages of the developed methodological framework for IT project management are summarized.

The practical application of the proposed methodological framework is presented in Chapter 5. Here, different aspects of the framework are validated through four detailed case studies in real IT projects: 1) The role of the IT business analyst in a big data project - a data-driven approach to business analytics at GfK; 2) Data analytics for DevOps effectiveness (at SAP); 3) An analytics-driven approach to agile software delivery (Financial Times); 4) Improving business analytics through generative artificial intelligence (Financial Times). The case studies demonstrate the applicability of the methodological framework in different contexts, as well as its effectiveness in solving complex analytical problems.

Chapter six develops a comprehensive educational framework for applied analysis that aims to build on the methodological framework for analysis in IT projects to give students practical skills in applied business analysis to bridge the gap between academic knowledge and the needs and requirements of industry. A multi-faceted approach is adopted that integrates the latest technological advances and educational methodologies. The basic principles of designing an educational framework - relevance, adaptability and experiential learning are laid down. The proposed educational framework is described in detail (including a diagram). The structured curricula, teaching methods and expected learning outcomes that are relevant to the objectives are described, with an emphasis on technical competence in analysis and strategic decision-making skills. A strategy is proposed for implementing the framework, ensuring its effectiveness and continuous improvement. The author's summary of how the educational framework integrates with broader educational goals is very impressive, as are the directions given for future training in business analytics and IT project management.

Chapter seven of the study focuses on the validation of different aspects of the proposed educational framework. Four case studies demonstrating its application in real-

world academic settings are examined: 1) Teaching data mining for applied business analytics at Boston University; 2) Teaching data mining techniques to applied business analytics students using interactive tutorials; 3) Practical implementation of analytical models in applied business analytics courses; 4) Generating synthetic data for applied business analytics projects. The case studies are based on the two courses “AD699 Data Mining for Business Analytics” (PhD student participated in the development of the interactive practice topics) and “AD899 Capstone Project in Applied Business Analytics” at Boston University and demonstrate how the framework prepares students for real-world analytical challenges by combining theoretical knowledge and practical experience.

Chapter Eight is titled "Discussion" and discusses the integration and synthesis of the research findings in this dissertation on methodological and educational frameworks for applied analytics in IT projects. A critical analysis of the two proposed frameworks against established industry standards is made. Gaps in existing approaches are identified and opportunities for effectively addressing them with the proposed frameworks are indicated. Their contribution to IT project management and business analysis education is highlighted. This chapter also proposes directions for future research towards improving the methodology, developing an educational framework, and stimulating innovation in applied analytics in IT projects.

Chapter Nine contains the main conclusions and implications of the dissertation research. Recommendations for practitioners and educators in the field of IT and business analytics are offered. Directions for future research on the topic are outlined in the direction of empirical validation in different contexts, integration of advanced technologies, specialization for specific project types, refinement and extension of the two proposed frameworks, etc.

Three appendices have been added to the dissertation, including two additional business cases and one additional educational case.

The dissertation is developed with precision; the text is clear, precise and analytical. The rules of good language and scholarly style of writing research papers have been followed.

6. Contributions of the dissertation

The results achieved in the dissertation are original and correspond to the stated aim and objectives. The contributions of the thesis, in my judgment, can be systematized as ***scientific and practical*** as follows:

Scientific contributions:

- ***A methodological framework for integrating analytics in IT projects is developed***

The proposed framework demonstrates a unique approach to the evolving needs of the data and technology-centric environment. By leveraging current best practices and industry standards and filling gaps in existing methodologies, it offers a comprehensive innovative solution for analytics in IT projects.

- ***Application of modern analytical techniques***

A significant contribution of the author is that he provides new approaches to improve processes and decision making in IT projects. The advanced analytical methods and technologies such as machine learning, Big Data analytics and generative AI integrated in the dissertation enrich the existing scientific knowledge in the field.

- An educational framework for applied business analytics is developed

The contribution of the dissertation is the overall innovative learning approach that combines theoretical knowledge with practical skills of students, thus preparing them for real analytical challenges in business.

- Integration of analytics in business analysis education

The introduction and integration of analytics tools and technologies into the curricula is an important contribution to the development of the training methodology for future IT project management and business analytics professionals.

Practical and applied contributions with relevance for industry and education include the opportunities that the research provides for:

- Application of the methodological framework in real IT projects

- Improving DevOps processes through analytics;

- Educational innovation in analytics;

- Providing a tool for business analysts across industries.

Contributions can be identified as enriching existing scientific knowledge and research advances in practice, as well as creating new and modifying existing methods, approaches, models and algorithms to solve the problems posed in the dissertation.

I consider that the aim of the dissertation has been achieved.

7. Assessment of the publications on the dissertation. Assessment of compliance with the minimum national requirements and with the additional requirements under Article 1a, paragraph 2 of the Regulations for the Implementation of the Academic Staff Development Act in the Republic of Bulgaria.

The doctoral candidate has submitted a list of 12 scientific publications related to the thesis, all in English. Three works are independent [4, 7, 11 of the List of publications related to the dissertation research], the remaining 9 are co-authored, in five of which he is the first author. This is an excellent testimonial to the PhD student's capacity for successful research and publication.

In 7 papers [1, 2, 3, 5, 8, 9, 11] the results of the application of the proposed methodological framework in a real industrial setting are published, in the remaining 5 – the results of the application of the proposed educational framework in a real academic setting are presented (Boston University and New Bulgarian University).

The publications were made between 2015 and 2023. Article [2] was indexed in Web of Science, published in 2023 in the journal Mathematics and Computer Science, which is in quartile Q4. Paper [1] is indexed in Springer Link and is in press. Publications [3] and [8] are indexed in OpenBU (Boston University's Open Online Library). The remaining eight papers are indexed in the Central and Eastern European Online Library (CEEOL) and are published in the proceedings of the international conference “Computer Science and Education in Computer Science” jointly organized by Boston University, University of Applied Science, Fulda, Germany and New Bulgarian University.

The publications sufficiently reflect the results and contributions of the dissertation to the specialized scientific audience.

I have no doubts that the dissertation and the results obtained are personal work of the PhD student.

There is no record of citations of publications.

The minimum National requirements for obtaining the Ph.D. degree in professional field 4.6. Informatics and Computer Science have been met, as well as the requirements of the NBU Regulation, according to which at least 30 points must be available in indicator group G. The candidate has 36 points in this indicator.

8. Using the results of the dissertation in scientific practice

The research and results of the dissertation developed by PhD student Penko Ivanov offer a comprehensive approach to the management and training of IT analytics projects and in this sense could be used for the development and improvement of university programs for master's courses, as well as for corporate training. At this stage, they have been effectively applied in the patented BU MET AD699 Data Mining for Business Analytics graduate course developed by the PhD student at Boston University and in a graduate course "Business Analytics in IT Projects", presenting foundational knowledge and skills for applying business analytics to IT projects in a corporate environment.

All of this is a testament to the significance of the results and their applicability.

9. Abstract

The abstract meets the requirements of the Regulations for Implementation of the Law o Development of Academic Staff in Republic of Bulgaria. It adequately and faithfully reflects the main provisions of the dissertation as well as the results and contributions achieved.

10. Critical remarks, questions and recommendations

I have no significant critical remarks to the dissertation except the following: the last two chapters (eight and nine) of the dissertation with important achievements on comparative analysis with existing approaches are absent in the abstract. Through this analysis, the novelty, originality and usefulness of the contributions to which the entire eighth chapter is devoted are defended.

In the abstract in Bulgarian, two different terms are used in the same context: *analysis* (the title of the thesis is "Analysis in IT projects", translated into Bulgarian) and as the dominant term in the text – *analytics*. In the public defense it would be good for the PhD student to explain the difference in their conceptual content.

Recommendations:

I recommend the PhD student to continue the research and expand the dissemination of the results, as the topic is highly relevant and has broad prospects for development. In order to increase visibility among the world scientific community in his future work, I recommend Penko Ivanov to strive to publish in scientific journals, refereed and indexed in world-renowned databases with impact factor and impact rank.

The remarks, questions and recommendations made in no way diminish the high scientific value of the dissertation and the excellent impression from it.

11. Personal qualities of the author

I do not personally know doctoral student Penko Ivanov and my impressions are only based on presented dissertation.

CONCLUSION

The dissertation work of MSc Penko Zhelev Ivanov contains significant scientific and applied results, which represent an original contribution to science and practice, and meets the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation and the Regulation for the Development of the Academic Staff of the NBU. The minimum national and NBU requirements to be fulfilled by the candidates for the acquisition of a scientific degree in professional field 4.6 Computer Science and Informatics have been fulfilled.

The abstract, the publications related to the dissertation work, and the implementations in the teaching process meet the requirements for acquisition of the educational and scientific degree „Doctor“ in professional field 4.6 Informatics and Computer Science. I believe that the PhD student is an erudite scholar, possesses in-depth theoretical knowledge in his professional field, as well as proven abilities for independent research.

All of this provides me with convincing evidence for an entirely positive evaluation of the dissertation. I propose the scientific jury to award MSc Penko Zhelev Ivanov an educational and scientific degree “Doctor” in field 4.6 Informatics and Computer Science, field of higher education: 4. Natural Sciences, Mathematics and Computer Science.

8.09. 2024 Reviewer :.....

/Prof. Dr. Maria Hristova