



REVIEW

by Prof. PhD Julian Vasilev

University of Economics – Varna,

Professor in professional field 4.6 „Informatics and computer science”, validated in the register of academic composition of The National Academy of Sciences „Habilitation persons with science indicators”; scientific specialty „Application of computing in economics”

Author of the dissertation work: Daniela Pencheva

Theme of the dissertation work: Business intelligence in retail trade with fast moving consumer goods (FMCG)

Scientific Advisor: Assoc. Prof. PhD Silvia Parusheva

Primary unit that discovered the procedure for the thesis defense: Department of Informatics at the University of Economics Varna

Reason for writing the opinion: Order No RD-06-65/04.04.2022 of the Rector of the University of Economics Varna for the opening of a procedure for the protection and determination of the composition of a scientific jury; held the first meeting of the scientific jury on 06.04.2022.

Professional direction: 3.8 Economics

Doctoral Program: Application of Computing in Economics

I. Total labor performance

The work is in a total volume of 233 pages. It is structured as follows: introduction, three chapters, conclusion, literature and applications used.

The aim is to „apply a business intelligent approach in the retail trade of fast moving consumer goods, proposing a model of a business intelligent module for order management to suppliers in the retail chain and develop a prototype”.

The object of the study is „the management of orders to suppliers in FMCG retail chains”.

The subject of the study is „ the development of a model of an intelligent module and its prototype for order management to suppliers with the application of the business intelligent approach”. The research thesis is related to positive expectations for the operation of the proposed module.

Chapter 1 (60 pages) is entitled “Improvement of trade information systems through BI technologies”. The text starts with the processes of digitization in retail (item 1.1). Continues with the different types of software systems in trade, the

supplier relationship management system (item 1.2). The application of business intelligent systems in retail (item 1.3) is being investigated. Specific artificial intelligence software systems used in the FMCG retail trade (item 1) have been studied. 4).

Chapter 2 (69 pages) is entitled „Conceptual model of a business intelligent module for managing orders to suppliers”. In t. 2.1 UML and BPMN standards have been studied. The author's position is highlighted. The author reveals one of its ideas „the necessary quantities of products for future periods can be calculated based on estimated values calculated using intelligent methods „ (p. 86). The text in item 2.2 starts with a model with the highest degree of abstraction and continues with models with a lower degree of abstraction. Models are made professionally.

Chapter 3 (56 pages) is entitled „Functional prototype of a business intelligent module for managing orders to suppliers” (3.1). The author argues her choice (MS Power BI Desktop, Alteryx Designer) of analytical platform (item 3.2). A numerical example has been developed for approbation of the proposed model of a module for order management to suppliers (item 3.3).

The **conclusion** provides key conclusions, recommendations, guidelines for future work.

A report on contributions is given.

A description of the structure of the tables in the data warehouse (Appendix 4) has been created.

The reference to the publications on the dissertation work includes 1 extended paper (co-authored with the scientific leader), 2 articles (independent) and 1 report (co-authored with the scientific leader; indexed in Scopus). All publications are in indexed editions. 3 of the publications are in English. 3 of the publications are available in full text version.

II. Positive moments

The PhD student Daniela Pencheva has worked hard. The work is precise. The text is oriented towards the theme of the dissertation work. In a positive direction, I consider the professional leadership of the Scientific Advisor Assoc. Prof. PhD Silvia Parusheva. The remarks given during the last discussion are reflected.

Chapter One clearly outlines the current state of the problem – supply logistics processes: (1) in terms of supply chain management and (2) in terms of their information provision.

The author concludes that the maintenance of the competitive advantage (in the FMCG trade) is supported by (1) an appropriate organization of internal logistics and (2) rapid management of processes in supply chains.

The high level of complexity of the processes in the logistics of supply is said.

Leading practices related to:

- (1) the use of specialized software for order management to suppliers;
- (2) UML application for business modeling of order management processes to suppliers;
- (3) application of business intelligent methods in the management of ordering processes.

For the description of the proposed conceptual model in **chapter two**, established formal means are used: business scenario diagrams, class charts, sequence charts, status charts, business process diagrams. The author argues his views on novelties in the functionality of software for order management to suppliers.

The text of **item 2.2** begins with a UML model with the highest degree of abstraction and is continued with models with a lower degree of abstraction. One part of the charts is made using UML, others through BPMN. These models/diagrams (14 shapes – from 2.8 to 2. (21) have been developed by the author and can be considered a contribution. When describing the functionality, the ideas for: (1) automatic drafting of orders and (2) compiling accurate forecasts are advocated.

An important point in chapter two is the author's views on data profiling, which can also be considered a contribution of the author.

Chapter three shows that the PhD student was able to collect data through meetings with representatives of retail chains. The specificities of the organization of supply logistics in each of the studied retail chains (item 3.1) have been identified. The author concludes that models in historical sales data (item 3.2) should be sought to forecast future sales.

In a positive way, I consider the developed numerical example (item 3.3. „Approbation of the developed prototype of a business smart module for order management to suppliers”) and its description. Data preparation for analysis was carried out using Ataccama DQ Analyzer and Alteryx Designer. Statistical models (sliding average and ARIMA model) were used to forecast sales.

The literature used shows continuity in the work of colleagues from the Department of Informatics. 193 sources have been studied, mostly from the last 5 years, including sources from 2021 and 2022.

The list of publications shows wide visibility of certain parts of the dissertation work. The published report has citations.

The submitted publications cover the **minimum national requirements for „Doctor” in professional field 3.8.**

I accept the contributions as achievements of the author.

The custom questionnaire created can be considered as an attached contribution of the author.

The author's concise work (in a volume of 43 pages) represents essential parts of the work.

III. Notes and recommendations. Questions

During the last discussion of the thesis in the Department of Informatics (22.03.2022) the author has received notes and recommendations from 4 colleagues who have produced 2 reviews and 2 opinions. After reading the work, I find that the notes given have been adequately reflected in the work. The changes made (the revisions) are in line with the other text. The dissertation work has a complete appearance.

I have the following **questions**:

1. How can ARIMA models be adapted to existing ERP systems (be part of their functionality)?
2. Why orders from vendors are usually stored in relational databases?
3. How can there be a connection between an online platform for accepting orders from customers with a desktop ERP system for sending orders to vendors?

V. Conclusion

I believe that the PhD student Daniela Pencheva has shown skills in developing an independent scientific study of the scale of the dissertation.

As a member of the scientific jury for awarding an educational and scientific degree „Doctor” I give my positive assessment of the readiness of the candidate Daniela Pencheva to acquire the educational and scientific degree „Doctor” in the professional field 3.8 „Econ

18.04.2022

Varna

With respect:



/Julian Vasilev/



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ИКОНОМИЧЕСКИ УНИВЕРСИТЕТ ВАРНА

Вх. № РД20-562 / 28.04.2022

REVIEW

by Prof. Kamelia Stefanova, PhD,
University of National and World Economy, Professional direction 3.8
"Economics",
validated in the Register of the academic staff of THE NATIONAL
ACADEMY OF SCIENCE "Habilitation persons with scientific indicators",
scientific specialty "Application of computational technique in economics"

Author of the dissertation work: Daniela Pencheva Pencheva

Theme of the dissertation work: Business Intelligence in Retail Trade
with Fast Moving Consumer Goods

Scientific Advisor: Assoc. Prof. Silvia Parusheva, PhD

Professional direction: 3.8 Economics

Doctoral Program: Application of Computing in Economics

1. Reason for writing the review

The procedure for the protection of PhD thesis was opened by the Department of Informatics, University of Economics - Varna. An order № RD-06-65/04.04.2022 has been issued by the Rector of the University of Economics - Varna for the opening of a procedure for the defense of the dissertation work and determining the composition of a scientific jury.

The first meeting of the scientific jury was held on 06.04.2022.

2. Dissertant data

The doctoral student Daniela Pencheva Pencheva was assigned to a full-time Doctorate on February 1, 2019 and was assigned the right to protection on February 1, 2022. She has completed all the required training tasks and submitted the necessary publications. I believe that the PHD student is appropriately focused on the current Doctoral Program, and I hope that training on it will contribute to the development of additional knowledge and skills in professional development, which

from the presented autobiography is mainly in the field of data work and conducting analyses.

3. Overview of the dissertation

More than ever, the data becomes the resource whose optimal management provides one of the main competitive advantages in our dynamic environment. Business processes are subject to profound transformations and each unit of data must be covered and adequately organized for subsequent analysis and support of management decisions.

Its structure includes introduction, three chapters, conclusion, literature used and Internet sources, and applications.

The introduction correctly sets out the basic parameters of operation and scope of the dissertation. **The purpose** of the dissertation is clearly formulated - "business intelligent approach in the retail trade of fast-moving consumer goods, proposing a model of a business intelligent module for order management to suppliers in the retail chain and develop a prototype". **The object and the subject** are logically derived from the objective and cover respectively "development of a model of an intelligent module and its prototype for order management to suppliers with the application of the business intelligent approach", and the applied focus is "the management of orders to suppliers in FMCG retail chains". **The main thesis** of the dissertation links the creation of the scope decision to the possibility of optimizing the planning and conduct of business processes in supply chains to achieve an up-quality in decision-making for efficiency of commercial activity. The formulated **tasks for implementation** clearly define the research approach.

The first chapter is entitled "Improving trade information systems through BI technologies" and amounts to 60 pages. It presents the guidelines for the digitalization of tasks and processes in the FMCG retail trade using new technological means. Special attention is paid to different types of trade information systems. As a result of the research, leading technologies are presented that can support the processes of order management and optimization: data warehouse, OLAP technology, knowledge mining, etc. The software systems for retail management with

FMCG are available on the Bulgarian market and three leading systems are presented, for which benchmarks have been proposed.

The second chapter consists of 69 pages and is dedicated to the development and presentation of a concept model of a business intelligence module for orders management to suppliers in a commercial company. The proposed module is based on the principles of bi approach, as described by the means of modelling. At the beginning of the chapter, the need for the application of the UML and BPMN standards is justified. With their help, section 2.2. graphically presents the main aspects of the functionalities of the business intelligence module, and the following diagrams are developed: conceptual business model, business scenario diagram, class chart, sequence diagram and status diagram. The basic processes related to the business intelligent module for orders management to suppliers are presented with the funds in the BPMN language in the business process diagram. All 5 components involved in the business intelligence module model are described in detail. With a suitable diagram, the logical model of the business intelligent order management module is detailed.

At the beginning of the **third chapter** (with a volume of 56 pages) with the title "Functional prototype of business intelligent module for managing orders to suppliers" is presented a study of the practice of three retail chains - Lidl, BulMag and Dar in the use of modules for orders management to suppliers. Based on the results obtained, it is concluded that in the practice of these companies there is no complete solution that provides functionalities for intelligent analysis. (a) the MS Power BI platform. For the purposes of correct data retrieval and preparation for subsequent analysis, the need to apply Alteryx Designer to further provide functionalities for the design and implementation of data transfer processes is defined. The need for a tool to improve the quality of the data and its correct profiling is satisfied, with Ataccama Data Quality Analyzer included in the prototype solution.

The tasks for the realization of the prototype are followed and its individual components are described. The data warehouse schema, which is built on a relational model, is arranged. Business rules have been drawn up to improve the quality of the data in the relevant component. The functionalities of the other components of the prototype are correctly presented. The prototype is sampled with data from the

"Dar" FMCG retail chain and which results are displayed visualizing interactive dashboards.

The **conclusion** presents the summary, sets out key recommendations and guidelines for future research.

4. **Evaluation of scientific and applied contributions**

I accept the directions for the achievements outlined in the dissertation, mainly as research of an applied nature.

I believe that the PhD student has made extensive efforts in the selection, research and application testing of different approaches and means that are appropriately selected, logically justified.

I agree with the wording of the five **development** contribution guidelines thus separated.

5. **Evaluation of the dissertation publications**

The reference to the publications on the dissertation work includes **one study**, which is co-authored with the scientific advisor, two independent articles and one paper (in co-authorship with the scientific advisor, which is indexed in Scopus). All publications are in indexed editions. It is positive that three of the publications are in English, which helps to gain wider visibility of scientific papers.

6. **Evaluation of the abstract**

The abstract is in a volume of 43 pages and correctly reflects the main points of the dissertation work, as well as a reference to the scientific and applied contributions therein.

7. **Critical notes, recommendations, and questions**

I would like to note that based on the thesis developed, an important guideline is emerging in which I would recommend that the PhD student continue her research efforts, namely the use of various tools to build analytical applications to measure the performance of the business, predict future behavior and support management decisions.

My questions to the PhD student are as follows:

- The dissertation lists different sources of input data. Can details be provided about which source, which data, in what volume, in what form and with what tool they are extracted, transformed and loaded into the data warehouse?

- What are the main key indicators that the company sets as goals for achieving and what do the results of the analysis show – what is the performance of operation and management?
- How do weather data affect the analysis and forecasting of FMCG deliveries?

8. Conclusion

In my opinion, PhD student Daniela Pencheva has made considerable efforts and has the necessary research skills to formulate and explore scientific tasks. The presented development is the result of in-depth research and familiarization with new methods and technologies successfully implemented in solving specific practical issues relevant to the development of information systems. I believe that the thesis presented meets the requirements established by the "Law on the Development of Academic Staff in the Republic of Bulgaria", as well as the rules of the University of Economics – Varna for obtaining the requested educational and scientific degree "Doctor".

All this gives me reason to recommend to the honorable members of the Scientific Jury, to award Daniela Pencheva the educational and scientific degree "Doctor" in professional field 3.8. Economics, scientific specialty "Application of computing in econo

26.04.2022

Signature:

/Prof. Dr. Kamelia Stefanova/