D. A. TSENOV ACADEMY OF ECONOMICS – SVISHTOV

REVIEW

for the acquisition of the educational and scientific degree "Doctor" in the scientific specialty "Economics and Management (Agricultural Economics)"

Reviewer: Prof. Aneta Deneva, PhD
Prof. PhD in the field of higher education: 3. Social, economic and legal sciences, professional field: 3.8. Economics, Scientific specialty: „Economics and management (Industry)"
Department of Industrial Business and Entrepreneurship,
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Author of the dissertation: eng. Petar Angelov Chernaev PhD student at the scientific specialty: "Economics and Management (Agrarian Economics)"

Topic of the dissertation: "Digital transformation of animal husbandry – problems and opportunities"

Grounds for submitting the review: Participation in the scientific jury for the defense of a dissertation pursuant to Order No. 1285/24.11.2025 of the Rector of D. A. Tsenov Academy of Economics.

I. General characteristic of the dissertation.

Volume: The dissertation consists of 265 pages, of which: introduction (5 pages); exposition in three chapters (234 pages); conclusion (3 pages); References (15 pages) The main text contains 36 figures and 24 tables.

Structure: The dissertation is structured into three logically connected chapters. The introduction and conclusion fully comply with the requirements and successfully fulfil their main function. Each chapter ends with *formulated conclusions*.

Bibliography: The list of cited literature is 15 pages long and includes 160 sources, of which 9 in Cyrillic and 151 in Latin script.

II. Assessment of the Form and Content of the Dissertation.

The animal husbandry is a major branch of the agricultural sector. In recent years, the need to increase its profitability and competitiveness has become increasingly apparent. The environment in which this sector operates is very turbulent, changing very quickly due to its specific nature - a combination of technological revolution, climate change and a complicated political situation. To the above, the specifics of European policy regarding agricultural production and the sectoral policy pursued by the state should be added. In parallel, the

introduction of innovative technologies into the sector faces a number of challenges and ethical considerations.

The dissertation work of eng. Petar Angelov Chernaev is focused on a very important topic – the digital transformation of animal husbandry, but considered in the context of a tool for increasing productivity and ensuring animal welfare. The doctoral student demonstrates in-depth knowledge of the subject. The topic is appropriately chosen and is of interest to both science and business practice. Its relevance is clearly, correctly and sufficiently argued by the doctoral student.

The **object** of the research is the opportunities and challenges in the digitalization and construction of the "IDEAL FARM" with its own feed and realization (meat direction).

The **subject** of this study is digital tools and the use of artificial intelligence (AI) for more cost-effective and environmentally friendly management of livestock farms and the realization of production (meat).

The **thesis** of the dissertation research is logically linked to the other attributes of the study - *through the use of properly selected and qualitatively implemented digital methods and interconnected innovative technologies, it is possible to increase both the quality and profitability of production while minimizing the impact on the environment.*

The main goal set by the doctoral student is to develop and validate a comprehensive framework for planning, implementation and evaluation of digital transformation in animal husbandry, allowing for informed management decision making and sustainable added value in various production and institutional conditions. The correct formulation of the main goal of the study and the specific objectives allowed the construction of five main hypotheses to present the research results.

A set of methods and approaches was used to conduct the research. The historical method, analysis and synthesis, descriptive method, etc. are widely used. The approaches applied include inductive, deductive, systemic, systemic-situational, etc. Appropriate mathematical and statistical tools were used. The study is based on the current state of the software and hardware solutions of a specific innovative company operating in the field of digital technologies.

Chapter One presents the theoretical aspects of the Digital transformation. A review of the legal framework and regulations for the digitalization of various aspects of agricultural enterprises has been carried out, such as: planning, control, optimization, monitoring, evaluation, management, compliance, communication, marketing, etc. In parallel, a comparative analysis of various methods for digitalization in livestock farming, which are applied in Europe and the world, has been carried out in terms of goals, technologies, results and challenges. Generalized methods for digitalization of livestock farming are presented. Special attention is paid to the possibilities of using artificial intelligence in animal husbandry (AI-L). A proprietary classification has been generated to assess the different types of sensors and their profitability, and the main directions of digital development of animal husbandry as a business have been summarized. The "Farm to Fork Strategy" has been analyzed in detail as a complex system of technical solutions that guarantee consumer awareness and security. Various technical solutions have been formulated for individual processes. Innovations in animal husbandry with a contribution to the green economy have not been omitted. For this purpose, the environmental effects and the green economy have been studied. The sources of emissions (including methane), solutions through selection, nutrition, automation and circular economy (waste management and recovery) have been outlined. In point 3 of Chapter One, the general characteristics and opportunities for the development of automation in animal husbandry processes are examined.

The subject of consideration in the second chapter is the classification of processes and technical solutions depending on the type of animals and their breeding method. The possibilities for digitalization of eight main processes are presented - from feeding automation to herd management. In this context, ERP systems for animal husbandry are considered, which

should upgrade the standard modules with functionalities specific to biological assets, such as: identification, health monitoring, productivity and selection. In point 2 of Chapter Two, a theoretical economic model for managing the "Ideal Livestock Farm" is presented. It is accompanied by an analysis of investments. The following methodology has been adopted to assess the investment costs of implementing digital solutions. It is assumed that for each type of process (group of processes) one of the possible suppliers and an average cost value are evaluated. In the analysis, it was accepted that each solution should be evaluated independently, without looking for complexity and reduction of investments of scale. This methodology allows the model to be applied to companies of different sizes and ways of management.

At the end of the second chapter, the human factor in animal husbandry in robotization and automation of technological operations and the incentives and challenges for digitalization of agricultural holdings in the CAP are examined.

Chapter three presents digital solutions for smart livestock farming in the Republic of Bulgaria. The roles of the farm, veterinarians, breeders, accountants and state platforms such as VETIS, EASRJ and the e-portal of the National Revenue Agency (NRA) are examined. The study is based on the ERP system "FermaWeb" and its interaction with hardware solutions for identification, drawing and climate control, as well as ERP "Agrosystems" for tracking the food chain. The study reveals differences in attitudes and perceptions towards digitalization depending on the hierarchical level of the farm participants. The main challenges include: lack of competence in working with technologies, complexity of the proposed solutions and absence of a comprehensive implementation strategy. In over 70% of farms, digitalization is implemented fragmentarily, without sufficient training and integration between systems. Only half of the farms are ready to invest in improving qualifications. The analysis shows that although Bulgarian farms lag behind in terms of actually implemented innovations, the challenges they face are similar to those in other EU countries.

One of the main contributions of the dissertation work is also presented – the development of an innovative system for reproduction management using artificial intelligence (AI). The system supports selection activities through automated prevention of inbreeding, intelligent selection of genetic combinations, synchronization of estrus and remote collection of biometric data.

At the end of the third chapter, the prospects and directions for the development of digitalization of animal husbandry in Bulgaria are discussed. and the digitalization of animal husbandry in Bulgaria.

The volume of the dissertation, the illustrative material – a total of 36 figures and 24 tables – and the scientific literature reviewed meet the requirements for this type of scientific research.

The dissertation is distinguished by its concise and fluent expression, good knowledge and correct application of the scientific apparatus, and ability for analysis and synthesis.

The rules of scientific ethics have been observed in the development of the dissertation. The doctoral student demonstrates a good command not only of the specific terminology related to the topic of the dissertation, but also of the approaches and methods of analysis used. This is a testament to the presence of the necessary competences regarding the definition of a scientific research problem, the development and verification of hypotheses, the evaluation of research results, the identification of unresolved or insufficiently resolved problems in practice, and future steps to overcome them.

Literary sources are cited correctly, in accordance with the established citation style.

The 54-page **abstract** adequately presents the structure and content of the dissertation. In terms of form and content, it fully complies with the requirements for its preparation.

III. Scientific and scientific-applied contributions of the dissertation work.

The scientific and scientific-applied contributions of the dissertation can be found in the following areas:

1. A theoretical model has been developed for optimizing production costs in meat production through the integration of PLF, IoT, and AI, linked to traceability and quality assessment—a model oriented toward the concept of an "Ideal Farm."
2. A systematization of digital technologies has been carried out in three areas (identification, traceability, automation), including a managerial classification of identification methods.
3. A typology of livestock farms and a methodology for assessing the impact of digital solutions (on a scale of 1–10) have been established, supporting the selection of investment priorities. The phenomenon of "virtual sheep" has been analyzed, and an evaluation of potential losses resulting from its existence has been performed.
4. A prototype of a reproduction management system (mating plan) has been created, using artificial intelligence to prevent inbreeding and optimize inseminations. Data and partnerships for its training and validation are described.
5. A process-chain framework for traceability has been developed, integrating EID, GS1, and blockchain for quality management and customer trust.

It should also be noted the significant practical contribution of the development: Extensive field coverage (100+ farms in Bulgaria and reference visits in 4 countries), providing validated practical guidelines for implementation.

The contributions highlighted are original, real, and significant for economic science and practice.

The doctoral student presents five publications on the topic of the dissertation – three articles, one of which is published in a scientific publication, referenced and indexed in world-renowned databases of scientific information and two papers published in non-refereed peer-reviewed journals or published in edited collective volumes. Four of the publications are written individually.

With the list presented, the doctoral student proves that he meets the minimum national requirements, scoring 63,33 points (with 30 required) in area 3. Social, economic, and legal sciences, professional field 3.8. Economics, in accordance with the Act on development of the academic staff in the Republic of Bulgaria.

IV. Critical notes, questions and recommendations on the dissertation work.

The doctoral student's *idea* to summarize and draw conclusions after each chapter is a good one. Some of them are well organized and clearly outlined, but others need to be refined. (pp. 173-175).

The conclusion successfully *summarizes and draws the main results*. It is positive that it is here that the doctoral student has indicated and justified the extent to which the goal and objectives have been achieved and the extent to which the individual hypotheses have been confirmed, but it is not necessary to present the doctoral student's contributions precisely in the conclusion. There is a corresponding reference for this.

The critical remarks made are not of a fundamental nature and cannot significantly affect the positive assessment of the substantive part of the dissertation research.

V. Summary conclusion and opinion.

The dissertation work of eng. Petar Angelov Chernaev is an in-depth independent study of a topical and clearly defined scientific problem – the digital transformation of animal husbandry The author demonstrates the ability to successfully conduct independent scientific research and correctly interpret its results.

This allows me to give a categorically positive assessment and I wholeheartedly recommend that the scientific jury award Petar Angelov Chernaev the educational and scientific degree of "Doctor" in Professional field 3.8. Economics, scientific specialty: "Economics and Management (Agrarian Economics), Agrarian Economics.

Date: 10.12.2025

Reviewer: .....

(Prof. A. Deneva, PhD)