

REVIEW

by **Prof. Dr. Anastasia Milanova Bankova,**

member of a Scientific jury for the defense of a dissertation
(Order of the Rector of Sofia University “St. Kliment Ohridski”
RD No 38-500/29.07.2024)

on the topic:

**“Artificial Intelligence – Readiness and Adoption in Small and
Medium-sized Enterprises“**

for awarding the educational and scientific degree "**Doctor**"

in scientific field 3.7. Administration and management

to **Linlin Ma**, PhD student at the Faculty of Economics and Business
Administration, Sofia University “St. Kl. Ohridski”

(the defense will take place on 24 October 2024)

I. General assessment of the candidate.

PhD student Linlin Ma holds a Bachelor's degree from Beijing University of International Studies, a Master's degree in Human Resource Development from Sofia University and has completed a Doctoral Programm in Business Administration at Sofia University. She speaks English and Bulgarian and at a working level – German and other Slavic languages. She has participated in internships and worked in various positions in various companies in Asia and Europe.

II. Evaluation of the dissertation.

a. Technical characteristics of the dissertation.

The presented dissertation on "Artificial Intelligence – Readiness and Adoption in Small and Medium-sized Enterprises" is developed on 133 pages – about 190 standard typewritten pages, 105 pages of basic

text, 17 pages of annexes (2 issues) and 11 pages of bibliography. Structurally, the work contains an introduction (it outlines the relevance of the topic, the purpose and goals of the work, research tasks), two chapters, the first one is devoted to the review of the literature on artificial intelligence – the diverse views and models of its use in enterprises, elements of the assessment of the situation in this regard in Bulgaria, some areas of application and practices in enterprises. The author exposes the ideas she adopts in her work and research. The second chapter is devoted to a detailed description of the research, discussing the results obtained. The work ends with a summary conclusion.

The work is illustrated by 13 figures and 26 tables. The list of information sources contains 98 titles in Latin.

4 publications have been made on the dissertation, one of which is co-authored.

The summary, in a volume of 42 pages, correctly reflects the content of the work, includes an assessment of the contributions of the work by its author, a list of the author's publications on the topic.

From the submitted documents it is evident that Linlin Ma has fulfilled the requirements of the doctoral program and the state requirements for the doctor's degree according LDASRB (Law on the Development of the Academic Staff in Republic Bulgaria) for the scientific field "Social, Economic and Legal Sciences", professional direction 3.7. "Administration and Management".

The technical characteristics of the dissertation make it possible to assess that the work meets the formal requirements for such work.

Regarding the content of the dissertation, the following assessment can be given:

b. Actuality of the topic.

The relevance of the topic of the dissertation can hardly be questioned. At the same time, the focus of the study is on Bulgarian companies, for which it is found that there is not enough research to bring out the problems and opportunities for adoption of technologies related to artificial intelligence in them.

c. Clarity of the goals.

The goals of the dissertation are clearly stated. The main goal is to identify and analyze the factors related to the readiness and adoption/use of artificial intelligence in various groups of companies in Bulgaria, to extract the key incentives and barriers for the integration of these technologies into the structure of organizations. The object of the study is Bulgarian companies from various industries in terms of their degree of readiness and actual adoption of technologies related to artificial intelligence. The subject of the study is the model for readiness and adoption of artificial intelligence technologies in a technological, organizational and environmental context.

The hypothesis is that different groups of organizations formed on the basis of their characteristics from the point of view of the "technology – organization – environment" model differ in the degree of readiness and adoption of artificial intelligence technologies. Special attention in the study, among other characteristics, is paid to the impact of the industry, the size of the organization and the existing technological infrastructure on the degree of readiness and adoption of artificial intelligence technologies. The formulation of hypotheses in the dissertation needs to be refined.

The limitations of the study, which the author herself points out, stem from the fact that it is based on a specific group of organizations, secondly, the dynamics and variability in the field of artificial intelligence and its use in business is a great challenge for research. All this does not allow the generalization of the results of the study.

d. Evaluation of the structure of the dissertation.

From a formal point of view, the dissertation has a clear, traditional structure for such a work, which has already been described above. Otherwise, the text needs basic editing, throwing out unnecessary parts and structuring the important ones in a way that highlights them more clearly.

e. Content description of the dissertation.

The introduction of the paper briefly dwells on the history of the problem of artificial intelligence, it argues the importance of the topic today and its choice by the PhD student. She indicates the main goal, the object and subject of her research, the thesis and hypotheses on which she will work. The main goal of the dissertation is to reveal and analyze the factors that characterize the readiness and lead to the adoption of artificial intelligence technologies in practice in different groups of Bulgarian enterprises. The further content of the dissertation is briefly presented.

Chapter one is devoted to the theoretical foundations of the problem under consideration. The author begins with the definitions of the concept of "artificial intelligence", the different names of its manifestations, which are historically determined. The author examines the aspects in which they are used in organizations – in production, service, logistics, human resource management, customer service, etc.

The author also consider the models and their main characteristics that influence the readiness and adoption of artificial intelligence technologies in organizations. She chooses the one that relies on the characteristics of the technology, the organization and the environment in which it exists. She analyzes in detail the most important aspects through which each main characteristic indicated in the literature is revealed. She also argues the choosed model to be followed further in her dissertation.

In this chapter, the author also dwells on a description of the state of affairs regarding the adoption of artificial intelligence technologies in Bulgarian enterprises. The experience of foreign enterprises is also presented.

Chapter two is the most important for the dissertation. It presents the author's overall research. She consistently dwells on the choice of tools for the study (and she relies on a large European study conducted in 2020- European enterprise survey on the use of technologies based on artificial intelligence (2020), data collection and processing, analysis of the results obtained, conclusions and recommendations, aspects that should be further investigated.

In the work, all steps and aspects of the study are described in great detail - comprehensively and reasonably. This should be highly appreciated. Regardless of the limitations that are understandable for such a study, the author has made efforts to look from different points of view at the subject of the study, as a result of which we are presented with a voluminous work. In dissertations, researchers are usually satisfied with much less.

In the work, as already mentioned, the model of "technological, organizational and environmental characteristics" was used, complemented by "the use of artificial intelligence technologies in the

organization”, detailing the measures that were selected for each characteristic. The survey included 34 questions, mostly with Likert scales for evaluation, it was sent online, 223 answers were received, of which 81 were usable, 50 were complete.

The author begins her research with descriptive statistics, their analysis and evaluation. A special place has the description of characteristics called "demographic", such as the belonging of the enterprise to a group according to its size, the branch in which it operates, its ownership, the type of its location. The author is also interested in the decision-making process in the enterprise, in which market it operates, whether there is already experience with artificial intelligence, where the software comes from - created by the organization itself, bought, freely available, modified or not, what are the characteristics of data management, investments in information technologies, a detailed description of the experience with artificial intelligence technologies and others.

The characteristics considered are related to the chosen model and their importance for assessing the readiness and adoption of artificial intelligence technologies (as fact and intention). The reliability of the collected data was evaluated.

The author then selects and conducts a factor analysis to extract the latent variables behind the survey responses and which helps to arrive at fewer generalized variables. Before that, the author checks whether the collected data is suitable for factor analysis. It also applies various tests to verify the results of factor analysis and prove their significance. 5 factors are extracted and named – adoption of artificial intelligence technologies, regulatory problems of using artificial intelligence (AI), awareness (knowledge) of the AI problem, attitude towards AI, difficulties (barriers to its application).

To test the hypotheses, the author makes two cluster analyses in sequence. The first (hierarchical and non-hierarchical) is for the disclosure of groups and the assignment of enterprises to them. Of the extracted factors, two are not suitable for the formation of the groups, and three turn out to be significant. Four clusters have been formed, 33, 12, 13 and 6 organizations are assigned to them, respectively. The author has described in detail the characteristics of the cluster organizations.

The second cluster analysis examines the impact of in depth understanding of AI technologies, the intensity of their use, and plan intentions on the actual adoption of such technologies. On this basis, 4 groups of enterprises have been distinguished, and appropriate names of each have been chosen. The model of the penetration of artificial intelligence technologies is also discussed here. In this way, the author examines the problems of readiness to adopt and apply technologies related to artificial intelligence in organizations from different perspectives.

The study of the dissertation is comprehensive, interesting and creatively executed. It is also useful as a toolkit and as a basis for future work and monitoring of developments. These studies have a variety of practical benefits.

f. Assessment of the contributions of the dissertation.

I accept the contributions of the dissertation made and summarized by the author. She focuses on the specific results of the survey for Bulgarian companies. I would also add more general contributions related to the review and evaluation of approaches to the study of the readiness and adoption of artificial intelligence technologies in the work by organizations, the development of tools for such research, which can be used in the future, could be enriched and developed and, of course, its

application in the study of Bulgarian companies and the results obtained from this.

Regarding the specific study, the author points out the following contributions, which I accept:

- This study identifies three dimensions of AI readiness related to AI adoption. In the technological dimension, the richness of internal data is important; in the organizational dimension, AI awareness and attitudes are important; and in terms of environmental conditions, external financing is vital.
- This study draws conclusions about the behavior of Bulgarian companies in the adoption of AI technologies based on “in depth understanding” and “intensity of use”. “planning/ intentions of use”. It identifies four types of players in terms of the adoption of AI technologies. They are leaders, lagging behind, catching up and willing to be leaders.
- Based on clusters, this study shows significant differences in AI penetration channels. Leading companies are developing AI technologies mostly in-house, while catch-ups are modifying the solution and laggards are preferring to buy/find ready-made products.

Finally, the author points out the importance of the results of the survey for business management and politicians in arguing important decisions.

g. Critical remarks and recommendations.

An indisputable positive assessment should be given to the tools used and the pursuit of multifaceted work. In this respect, the author has

done more than what is expected from a doctoral dissertation. Along with this, I have some notes on the work:

1. The title states that the survey is aimed at small and medium-sized enterprises. Getting acquainted with the dissertation, I do not get the feeling that the specifics of this group of enterprises are reflected, despite their mention several times in the dissertation and despite the fact that the majority of Bulgarian enterprises are small (micro). Moreover, the questionnaire also includes large enterprises, the survey itself includes 7 large organizations and only 3 medium-sized ones.
2. Not everything that has been done in the process of developing the dissertation should find a place in its final text. There are a lot of superfluous things. One example. Appendix 2 presents a list of companies that have been interviewed. In the text of the dissertation, the question of interviewing is not addressed – what kinds of interviews, with whom, for what purpose, a summary presentation of the results. At one point in Chapter One, the appendix is cited. The text is related to the practices of artificial intelligence technologies used by companies. Unfortunately, there is no correspondence between the companies in the text and the appendix.
3. When discussing the results of the author's research, it is good to position them among the results achieved in other studies – something that the author probably wanted to do. This positioning is associated with comparisons and evaluations. Unfortunately, the work again presents results of other studies in the style of "review". Or maybe the author wanted to add something? Anyway, the place of such texts is in the first chapter.

4. The questionnaire for the study is too voluminous, suitable for large-scale research within a specially funded project carried out by a team. It is difficult for me to imagine how heads of Bulgarian companies would bother to fill it in on their own initiative. The author should balance "desire and resource" in the future. Here I should mention that in some countries large studies have long been carried out by teams in which PhD students have their own separate contribution, which they defend. This practice does not exist in our country.
5. The requirement to indicate a single correct answer for some questions is disturbing. For example, in the case of the location of the enterprise, there are no options suitable as an option for multilocal and virtual enterprises.

The critical remarks are rather recommendations for reflection.

The author herself points out the difficulties faced by the research on the degree of readiness and adoption of artificial intelligence technologies in the practice of organizations, which arise from the rapid changes and great diversity, from the deficits in knowledge about all significant factors in this field, about the technologies themselves, about the conditions in which they are used. Therefore, further study of these changes is necessary, as well as work to identify development trends in order to prepare for them in advance. The author has made a good start that should be developed in the future.

III. Conclusion.

Regardless of the remarks made,

based on the quality of the work presented, which I appreciate highly,

I find that

the author **Linlin Ma** has proven

that she can recognize significant problems, independently conduct very good quality research, develop recommendations for practice,

that is why I recommend with conviction to award **Linlin Ma** the educational and scientific degree of **Doctor**.

Reviewer:

/Prof. Dr. Anastassia Bankova/

Date:

15-th of September 2024, Sofia