TO:
THE SCIENTIFIC JURY

RE:
Resolution RD-38-154/27.3.2024
of the Rector of Sofia University "St. Kliment Ohridski "

OPINION

by

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on a dissertation thesis for obtaining a PhD in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.4. Earth Sciences (Cartography - Thematic geographical mapping)

Author of thesis: Milena Simeonova Stefanova
Thesis topic: 'Geospatial model for air quality assessment in the city of Sofia '

Relevance:
The dissertation topic has undeniable relevance and will continue to be a focus of research, stimulated by advances in geospatial technologies and expanding opportunities for scientific discussion of issues related to the quality of the urban living environment, as well as in the presentation of important spatial information for decision-makers.

Theoretical background and creative interpretation of literature
The structure of the exposition is inconsistent and the theoretical setting remains unclear. The introduction to the issues shows a good initial orientation and selection of emphases, but the texts contain unnecessary digressions and large amounts of borrowed texts, including translations, without discussion by the PhD student and interpretation in the context of the research interest. Chapter 2 contains mainly references and extracts from ExEA technical documents and regulatory European and national documents, which makes the presentation consistent with an annex to a technical report, but not the focused review needed here to support a scientific study. The beginnings of such a review can be found in part in subsection 2.2.
Chapter 3 turns its attention to Geographic Information Systems and their application to Ambient Air Quality (AAQ) management, where an argument in favor of geospatial modeling for research purposes is already found (Chapter 2.3). However, borrowing texts from GIS textbooks is not

applicable to dissertation research, where application and extension of knowledge acquired in the PhD training is expected. There are no summaries at the end of individual chapters, which prevents tracing the doctoral student's reasons for developing these chapters, as well as their relevance in the course of the overall research.
Despite the inconsistency of the presentation, I assume that the PhD student is well-versed in the application of GIS for spatial analyses and is familiar with the mechanisms for the management of AAQ.

Aim, objectives, research hypotheses, and research methods
The aim and object of the study are clearly stated. The objectives are in line with the goal, but the absence of a planned review of good research practices on the construction of specialized databases and geospatial models relevant to the analysis of AAQ in urban settings is notable.
There is no text addressing the object of the study - the city of Sofia, and the need to create a geospatial model to assess the air quality of this particular urban area. Such texts are found for the first time on page 99 (section 4.4.), in the chapter which, according to its title, is expected to present the implementation of the planned studies and results. On page 106 (as well as in the introduction and on page 25) it is stated that "The retention of polluted air over the capital is mainly due to the topography and climatic features of the study area. Due to its geographical position and climatic features, the Sofia Municipality is subject to the influence of numerous factors that affect air quality", but the PhD student does not support her claim with reference to scientific publications on the subject, which are numerous (including those of her supervisor). Essentially, there is a complete lack of literature review of previous scientific studies on ambient air quality in Sofia!
Brief text pointing to the methodology used is present on pages 70-74 and then, on pages 107-109. A very appropriate solution for a dissertation would be to separate these explanations into a separate chapter. It is not clear whether a preliminary study was made to determine the minimum number of baseline data points required to apply IDW interpolation to the area of the analysis site.

Presentation of the Results and Discussion
The presentation of the results starts in section 4.6. It is mainly based on the recorded exceedances of air pollution indicators by monitoring stations and without an analysis of the relationship of the values with the urban area of Sofia. Some of the comments in the text need rethinking and editing - this applies primarily to the AMS Kopitoto, where the influence of natural environmental factors, given the location of the sensors, is pronounced.
Pages 114, 119 and 123 briefly comment on important information regarding the qualities of the information sources, sensor placement and coverage that would be useful in discussing the results if presented as a discussion at the end of the thesis. Such texts remain "dissolved" in the general presentation and do not allow to trace the contribution of the PhD student to the research topic - this applies to all important items in the thesis - scientific reasons for conducting the research, author's methodological decisions, selection of information sources for the application of the chosen methodology, presentation of results and their discussion. For example, the comment on the need to optimise the horizontal monitoring structure of the ExEA in Sofia is found on page 93, but not in the conclusion. In essence, the conclusion presented here is not based on the results obtained in the study but repeats general texts from other sources.

It is not clear why the PhD student includes information on other potential sources of AAQ data at the end of the results text if she does not use them for her study and undertakes a comparative analysis with them.
The dissertation is well illustrated.

Contributions
Of the 5 contributions mentioned, I accept only those formulated in 2 and 3.
The remaining formulations I define as fulfilled subtasks necessary for the conduct of the research, but not as contributions within the meaning of the Regulations for the conditions and procedure for the acquisition of scientific degrees and occupation of academic positions at Sofia University (Article 64).

Assessment of the degree of personal involvement of the candidate in the contributions
Thus, the dissertation submitted for opinion forms the impression of a laborious study conducted by the dissertator with technical skill and perseverance. I accept that the PhD student has mastered and put into practice a system of validated research methods that have generated information of interest for the management of the urban AAQ in Sofia.

Critical comments and questions
My general impression is that the text has the structure of a technical report, and with an inconsistency of exposition that prevents the tracking of important aspects of this research study - research hypothesis, reasoning in the selection of approaches and methods, results, and discussion. As a serious drawback, I would define the lack (including graphically presented) of a methodological framework that would allow following the logic of the research, its structuring by steps and methods of research, and accordingly - of the formation and building on original results.

I regard the too general manner of the conclusion and the absence of discussion as making it very difficult to recognize the results and the personal contribution of the PhD student. The latter leads me to pose the following questions:

1. What are the most important spatial dependencies that you find in the course of your research in the relationship between the spatial structure of Sofia and the AAQ?
2. What in your results gives you reason to state in your conclusion on p. 163 that ‘The air quality problem is very much geographically determined’?
3. What is the usefulness of the IDW interpolation approach against the background of the dispersion modeling used in the development of the current Ambient Air Quality Programme of Sofia Municipality? How can the results of your spatial model support decision-making for the management of air quality in the Sofia Municipality?
4. Considering the results you have obtained, would you recommend the IDW interpolation-based approach you have used for the purpose of informing decisions in the management of AAQ in other cities in the country?
5. What is the most important conclusion you would draw regarding the source data - geospatial modeling relationship you tested? How could it be improved?

Published articles and citations

Two separate draft publications presenting parts of the thesis are presented. Citations are not available.

CONCLUSION:

Despite the numerous critical remarks presented in this opinion, I accept that the Ph.D. student possesses theoretical knowledge in the relevant specialty and demonstrates the capacity for independent research.

Based on the above, I accept that the submitted dissertation meets the requirements of the Law on the Acquisition of Scientific Degrees and Academic Positions of the Sofia University "St. Kliment Ohridski". I express my POSITIVE opinion for awarding the degree of PhD to Milena Simeonova Stefanova in the professional field 4.4. 4.4.1 Earth Sciences, specialization Cartography - Thematic geographical mapping**.**

June 10th, 2024 Member of the Scientific Jury: Bilyana Borissova Digitally signed by Bilyana Borissova Date: 2024.06.10 12:19:31 +03'00'

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