

REVIEW

of the official opponent **Veronika Chala**

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for the qualification work of **Zhong Demin** on the topic:

«Benchmarking of the formation of circular clusters»,

submitted for the Doctor of Philosophy degree in speciality

292 – International Economic Relations

Relevance of the topic of the qualification work.

Cluster economic models, although relatively new, are at the same time proved to be effective tool for entrepreneurial activity and innovations promotion. The economic benefits obtained, and in this case, especially, environmental, attract endless attention from strategic managers, governments and scientist all over the world. Global economic development is increasingly dependent on the implementation of innovative production models and the efficient use of resources. The cluster approach in the circular economy enables businesses, research institutions, and government structures to collaborate in implementing resource-efficient strategies. The industry-driven cluster effectively serves the circular bioeconomy by offering a collaborative model to shape biotechnology-based business supply chains supported by the research and development needed to scale the business. Thus, Zhong Demin's dissertation «Benchmarking of the formation of circular clusters» is an actual vector for the development of this mainstream idea. The study is devoted to deepening the theoretical concepts of circular cluster formation and the development of applied recommendations for improving the level of development and quality of circular cluster formation in China on the basis of benchmarking.

The dissertation is a component of fundamental scientific research on the topic: "National concept of environmental safety of society and inclusion of the circular economy in the context of a pandemic" (state registration number 0121U109485); fundamental scientific research on the topic: "The Concept of Recovery and Green Reconstruction of Ukraine" (state registration number 0124U000003); implementation of an international project (Erasmus+ Jean Monnet Module) on the topic: "European Inclusive Circular Economy: Post-War and Post-Pandemic Module for Ukraine" (registration number 101085640); "Goeconomic and Civilizational Challenges of the Global Economy" (state registration number 0121U111077).

The degree of validity and reliability of scientific provisions, conclusions and recommendations

The presented scientific statements, conclusions and recommendations in the dissertation are based on the provisions of the concept of circular economy, the use of methodological benchmarking tools for the formation of circular clusters. The high validity and reliability of the scientific statements, conclusions, and recommendations formulated in the dissertation are ensured by the logical consistency of the argumentation, the coherent structure of the research, and the systematic approach to developing its methodological foundation.

The obtained results are characterized by scientific reliability, clear interpretation, and adherence to established academic standards at all stages of the research.

The dissertation combines international and national theories of the circular economy and recent advances, combining theory with practice, qualitative with quantitative methods, national and foreign perspectives. The main methods used: the method of theoretical generalization – to substantiate the provisions of the concept of circular economy and the formation of the conceptual apparatus of research; the method of qualitative and quantitative analysis – to identify the essence of the problem through deductive reasoning; methods of analysis and synthesis – to distinguish systems for assessing the circular economy, which allows you to accurately and objectively reflect the development of the region through calculations based on data;

monitoring method – to detect changes in cluster analysis; SWOT analysis method – when identifying the strengths and weaknesses of the implementation of the circular economy in the region; methods of data processing, in particular: the method of statistical analysis, the evaluation system with interdependent indicators comprehensively reflects the requirements of the assessment in a hierarchical structure; methods of correlation and regression analysis – to identify dependencies between indicators; cluster analysis – the study uses analyses of the main components and AHP to assess the level of development of the circular economy; tabular and graphical methods – for visualization of data, main provisions and research results.

Content and structure of the dissertation

The work is logically structured, with its sections well-aligned and interconnected. The objective of the dissertation research is clearly defined, and the subject and object of the study are correctly identified. The completion of the stated tasks contributes to the full achievement of the defined objective.

The thesis develops an evaluation system to measure the development of the regional circular economy, in particular, in the city of Xinyu, based on the considered reference practices for the formation of the circular economy and circular clusters, in order to identify effective strategies and mechanisms to promote the sustainable use of resources and protect the environment.

It is studied that China's circular economy exhibits a contrasting model of environmental protection according to economic development and resource use: strong in the west, weak in the east, and moderate in the central regions. It is noted that there are significant regional differences in environmental protection. In the east, there is a two-tier differentiation: Beijing, Tianjin, Shanghai and Fujian are doing well (first and second levels), while Guangdong, Jiangsu, Shandong, Hebei and Liaoning are worse (fourth and fifth levels). In the central region, Anhui, Shanxi and Henan have a low level of environmental protection (fourth and fifth levels), while Jiangxi, Hunan and Hubei have a moderate level (third level). In the western region, Xinjiang, Sichuan, Inner Mongolia, and Shaanxi have low levels (fourth and fifth levels), while Tibet,

Qinghai, Ningxia, Gansu, Chongqing, Yunnan, Guizhou, and Guangxi have moderate or better levels (level three or higher) (P. 80-103).

The dissertation develops a model for the development of the regional circular economy according to three dimensions of indicators: economic, resource and environmental indicators. They range from 0 to 1 after normalization. The origin (0,0,0) is theoretical, while (1,1,1) represents the ideal maximum. The model formed a cube in the first quadrant, divided into eight octants. The Regional Circular Economy Development Index is represented by a spatial point in the model, reflecting its status at a certain time. The path of evolution of the circular economy involves the transition of points from the first to the eighth octant over time. Accordingly, ten consecutive years of the region's development path are represented by a trajectory of ten points. It has been proven that the path of development is usually ascending, but can vary depending on the priorities of the region. Different regions can follow different paths for the same time series. The evolution of the development path of the regional circular economy is reflected by the spatial trajectory from the beginning of O near the 1st quadrant to the apex A of the 8th quadrant. This path records development, with the coordinates of each point representing economic, environmental and social indicators of viability at a given time (X, Y, Z, respectively) (P. 103-112).

The establishment of an environmental assessment mechanism has been proven to be an important measure to achieve the transformation of Xinyu High-tech Zone. The implementation of measures such as clear goals, the establishment of indicators, the creation of mechanisms, as well as the strengthening of state support, will help to contribute to the entry of the high-tech zone and large enterprises on the path of rapid development of green, low-tech zones, carbon circular economy and the achievement of coordinated development of the economy and the environment (P. 113-147).

From the point of view of benchmarking management, the dissertation analyzes the world standards of the circular economy, including the practice of development in countries and regions such as the European Union, Germany, France, Japan and the USA. This study, combined with China's circular economy practices, analyzed the

current situation and development problems of China's circular economy and accordingly put forward proposals (P. 181-186).

Scientific novelty of the dissertation work results

Reviewing Zhong Deming's dissertation allowed the conclusion that the dissertation exhibits the proper features of scientific novelty, focusing on the deepening of the concepts of international benchmarking of circular clusters and the methodological approaches to strategic management of their development and operational efficiency. The main results containing scientific novelty are in the following provisions:

- For the first time, a methodological approach was developed, which is reflected through a system of indicators for assessing the development of the regional circular economy in order to classify it according to characteristics in the provinces of China, on the basis of which the spatial distribution of the circular economy was carried out and regions were accordingly classified according to the use of China's resources;
- For the first time, a system of indices for assessing the regional development of circular economy clusters has been proposed on the basis of current legislation, regional experience and 35 indicators in the three dimensions "economy-resource-environment" (indices of economic production (C1), industrial structure (C2), consumption of resources (C3), use (C4), waste dumping (C5) and pollution control (C6), as well as ways of their development). On the basis of which a model for the development of the regional circular economy has been developed and the analysis of the evolution of the development path of clusters of the circular economy has been carried out;
- The conceptual justification and theoretical positioning of industrial clusters in the system of the circular economy in the projection of the world benchmarking of the formation of circular clusters has been improved;
- the system of interaction between enterprises, industrial parks and the government at the micro level of regional development of the circular economy and the method of measuring the degree of development of industrial clusters have been improved;
- The Xinyu High-tech Zone circular economy evaluation system was improved based on benchmarking and three-dimensional characteristics of the circular economy

and resource consumption indicators (B3) and (B4), on the basis of which a matrix for evaluating resource use indicators was developed;

- The conceptualization of the key problems of the implementation and operation of circular clusters, particularly in the Xinyu High-Tech Zone, including the challenges faced by enterprises, parks and government in planning and developing the regional circular economy, has been further developed;

- The environmental mechanism for evaluating the transformation of Xinyu High-tech Zone on the path of rapid development of green, low-tech zones, carbon circular economy, and the achievement of coordinated economic and environmental development has been further developed;

- The proposals for the development of the circular economy in the Xinyu high-tech zone for the planning of the industrial chain of the new steel industry of the circular economy and the scheme of the industrial chain of the circular economy of the coal and chemical industry based on the used correlation index between the Xinyu high-tech industrial park and domestic and foreign industrial parks have been further developed.

Theoretical and practical significance of the results obtained

The dissertation expands the theoretical basis of the study of the regional circular economy by analyzing its structure, functions, goals, characteristics and methods of evaluation. Attention is focused on the functioning of the regional circular economy and models of the circular economy in the context of regional development. The statement is formulated that the circular economy represents a new model of sustainable development, a paradigm shift in technology and economics. The dissertation improves the system of indices for assessing the regional circular economy by analyzing the strengths and weaknesses of existing systems from the National Development and Reform Commission, the State Administration of Environmental Protection and the National Bureau of Statistics (macro level) and relevant scientists. A performance evaluation system focused on the economy, resources and environment was created, using the analysis of the main components to identify 9 key components.

The dissertation presents a new method for assessing the development of the regional circular economy, using a system of primary indices to highlight the main components and increase scientific feasibility through the assessment of the AHP. This method comprehensively assesses the economy, resources, efficiency and various aspects of the development of the regional circular economy using the hierarchical analysis of the AHP.

The study offers scientific recommendations to strengthen the regional development of the circular economy by evaluating 31 provinces, municipalities and autonomous regions of China. The dissertation provides insight into the current state of the circular economy in the provinces, helping governments, businesses, and the public understand the regional development of the circular economy and offering recommendations for improvement.

Completeness of main dissertation provisions reflection in the publications of the author

The main provisions of the dissertation were published in 7 scientific papers, including 1 paper in the publication included in the international scientometric database Scopus, 4 papers in scientific professional journals of Ukraine, 2 papers in other publications based on the materials of conferences. The results of the applicant's research were reported and discussed at international scientific and practical conferences.

The volume and content of the published works indicate that they cover the main findings of the conducted scientific research, which have been tested and received positive evaluations at scientific events of various levels. The number of published scientific papers on the dissertation topic and the completeness of the reflection of the dissertation's findings in these papers meet the current requirements. The list of published works on the dissertation topic reflects the content of the work in accordance with the requirements.

All scientific results presented in the dissertation were obtained by the author independently. Of the scientific works published in co-authorship, only those ideas and provisions that are the result of the applicant's independent research were used.

Assessment of dissertation structure, language and style of presentation

The dissertation consists of an introduction, three chapters, a conclusion and a list of references.

The dissertation is written in business English with a scientific style of presenting its content, is characterized by integrity, semantic completeness, logical sequence of the issues considered, accuracy of the use of special terminology, clarity and objectivity of presentation of research materials. The text of the work is sufficiently illustrated with tables and figures. The volume, structure, and formatting of the work comply with the current requirements for dissertation formatting.

Absence (presence) of violation of academic integrity

The results of the review of Zhong Demin's dissertation for compliance with academic integrity indicate that the work includes all necessary references to primary sources and respective authors, in accordance with copyright law. The requirements of academic integrity have been upheld both in the dissertation and in the author's scientific articles and other publications.

The text of the dissertation has been checked for the presence of textual borrowings by Turnitin Similarity. According to the results of the inspection, the absence of textual borrowings without proper reference to the source was confirmed and it can be stated that Zhong Demin's dissertation on the topic: "Benchmarking of the formation of circular clusters" corresponds to the principles of academic integrity.

Remarks on the work and its debatable provisions

The following should be attributed to the shortcomings and remarks of a debatable nature:

1. It is essential to select and define specific indicators when developing an evaluation system for the growth of circular industrial clusters to ensure a comprehensive, objective, and systematic representation of their efficiency and development. (P.189-190)

2. As stated in the dissertation text (pp. 130-188), data correlation was conducted based on principal component analysis and the analytical hierarchy process. It would

be advisable to specify the measures taken when working with indicators to prevent multicollinearity and ensure the accuracy and reliability of the evaluation results.

3. The dissertation states that there are regional differences in the development of China's circular economy. When describing the analysis of these differences, in addition to the three dimensions—economy, resources, and environment—it would be useful to indicate whether other important factors (such as policy, culture, and technological level) were also considered and how these factors influence the formation of circular industrial clusters. (P. 190)

4. In the case analysis part, author chooses Xinyu High-tech Zone as the research object. What is the basis for selecting this area? What are the characteristics and advantages of this region in the development of circular industrial clusters? How can these characteristics and advantages be used as lessons for other regions. (P. 16)

5. In the end, the dissertatoin puts forward some countermeasures and suggestions to promote the development of circular industry clusters. The dissertation would significantly benefit from a discussion of the key challenges that these countermeasures and proposals may face in practice, as well as potential solutions to overcome these challenges in order to facilitate the effective formation and development of circular industrial clusters. (P.133; pp. 167-168)

It should be noted that these remarks are of a clarifying nature and do not underestimate the positive assessment of Zhong Demin's dissertation.

General conclusion and assessment of the qualification work

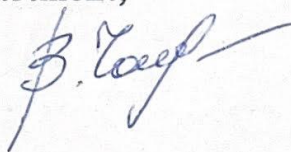
Zhong Demin's dissertation on the topic: “Benchmarking of the formation of circular clusters” is an independent qualification scientific work that is It contains scientifically grounded results of research personally conducted by the applicant, which address specific scientific objectives and are of significant importance for the development of modern concepts, theories, and future trends in the global economy in the context of the greening of the socio-economic system. The dissertation topic is relevant and well-explored, and the conclusions align with the research objectives set by the applicant, which have been fully accomplished. The results and conclusions obtained are of scientific novelty, important theoretical and practical significance,

make an undoubted contribution to the theory and practice of circular cluster formation and have been published in a sufficient amount of scientific articles and have undergone additional scientific validation.

Regarding scientific level, quality of theoretical and practical developments, structure, style of presentation of the material, it can be stated, that the dissertation on the topic: "Benchmarking of the formation of circular clusters" meets the requirements of the Procedure for awarding the degree of Doctor of Philosophy and the cancellation of the decision of the one-time specialized academic council of a higher education institution, other scientific institution on awarding the degree of Doctor of Philosophy, approved by the Resolution of the Cabinet of Ministers of Ukraine dated January 12, 2022 No. 44, and its author, Zhong Demin, deserves to be awarded the degree of Doctor of Philosophy in the field of knowledge 29 – International Relations in the speciality 292 – International Economic Relations.

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Signature of Doctor of Econ.Sc., Prof. V. Chala

I C E R T I F Y

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Tetiana RADKEYCH