REVIEW

by the Doctor of Economic Sciences, Deputy Director for the Education and Research Institute of Innovation, Nature Management and Infrastructure, Senior Lecturer for the Department of Transport and Logistics of West Ukrainian National University **Olena Borysiak**
on the Ph.D dissertation
«Benchmarking of the formation of circular clusters» by Zhong Demin
in the field of study 29 - International Relations,
speciality 292 - International Economic Relations

Relevance of the dissertation topic and its connection with research programmes, plans, topics

Limited access to natural resources, especially to natural energy and agricultural resources, as well as the growing impact of climate change, require a review of approaches to natural resource management. The principles of resource efficiency and climate neutrality are a priority for the global economy. The transition to circular resource use is aimed at achieving sustainable development. This transition includes minimising waste to source resources, extending the service life of resources through reuse, and transforming waste into new products or resources (recycling).

China, which is promoting a circular economy policy, is facing challenges such as low resource efficiency and pollution. Thus, the application of benchmarking tools aimed at studying the best global practices of circular clusters is strategically important in the transition to circular resource use and sustainable development in China.

In this regard, the results of dissertation «Benchmarking of the formation of circular clusters» by Zhong Demin are valuable. The study is devoted to deepening the theoretical concepts of circular cluster formation and developing practical recommendations for improving the level of development and quality of circular cluster formation in China on the basis of benchmarking.

The dissertation is a part of the fundamental scientific research project on the topic: «National Concept of Eco-Security of Society and Inclusion of the Circular Economy in Pandemic Conditions» (state registration number 0121U109485); fundamental scientific research project on the topic: «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); «Geo-economic and Civilizational Challenges of the Development of the Global Economy» (state registration number 0121U111077).

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

The scientific statements, conclusions, and recommendations presented in the study are based on the provisions of the circular economy concept and the use of benchmarking tools for the formation of circular clusters. The purpose of the study is to deepen the theoretical concepts of circular cluster formation and develop practical recommendations for improving the level of development and quality of industrial clusters as a result of empirical study.

The dissertation combines international and national theories of the circular economy and the latest achievements, combining theory with practice, qualitative with quantitative methods, and national and foreign perspectives. The main methods used were: the method of theoretical generalization - to substantiate the theoretical concepts of the circular economy and form the conceptual apparatus of the study; the method of qualitative and quantitative analysis - to identify the essence of the problem through deductive reasoning; methods of analysis and synthesis - to identify systems for assessing the circular economy, which allows for an accurate and objective reflection of the development of the region through calculations based on data; monitoring method - to identify changes in the cluster analysis; SWOT analysis method - to identify the strengths and weaknesses of the circular economy implementation in the region; data processing methods, in particular statistical analysis - the assessment system with interdependent indicators that comprehensively reflects the assessment requirements in a hierarchical structure; correlation and regression analysis methods to identify dependencies between indicators; cluster analysis - the study uses principal components analysis and AHP to assess the level

of development of the circular economy; tabular and graphical methods to visualise data, main points, and results of the study.

The structure of the dissertation is logical. It includes a study of the theoretical foundations of the circular economy, justification of the role of benchmarking in the practice of the circular economy, formation of a system of indicators for assessing the development of cluster circular economy, empirical analysis of the development of the circular economy in Xinyu city to develop practical recommendations for improving the level of development and quality of industrial clusters, forming of circular clusters, and formulation of a model for the development of a regional circular economy in China based on the analysis of circular clusters development evolution. The study proposes a new approach to the scientific assessment of progress in the High-Tech Zone of Xinyu.

The author has studied the theoretical provisions of the circular economy (p. 19-32), identified the features of the formation of industrial clusters (p. 38-44) which allowed for substantiating the provision on the expediency of combining enterprises into clusters on the basis of the circular economy, and clarified the role of benchmarking in the practice of the circular economy. It is emphasised that the circular economy improves resource recycling and minimises waste through cooperation in industrial clusters. Clusters can be classified by interconnectedness, innovation capacity, market mechanism and the role of government, formation mechanism, and industry level, which deepens our understanding of their characteristics and laws of development. The author proposes to introduce the best international practices of circular cluster formation in China on the example of the Xinyu High-Tech Zone in Jiangxi province. To achieve this goal, he used benchmarking tools.

The dissertation shows how benchmarking contributes to the formation of a circular economy in Xinyu City by analysing strategies for optimising resources and the efficiency of their use (p. 51-69). Scientific approaches to the circular economy assessment system are considered (p. 70-77). Innovative models and practices of

benchmarking in the circular economy of Xinyu are studied, summarising successful experiences for other regions.

The dissertation analyses the system of indices of circular economy as an important basis for assessment of the level of development of circular economy in China (p. 80-102). The dissertation proposes a comprehensive system of indices for assessing the activities of regional circular clusters, which covers indicators in three dimensions: «economy-resource-environment». The system of indices reflects the development of the circular economy from many dimensions and provides a scientific basis for policy development and decision-making. A comparison of resource and environmental indicators is carried out. It is established that the formation of circular clusters contributes to sustainable and efficient economic development. The creation of an indicator system for the circular economy and assessment methods, including a general welfare index, a method for assessing the sustainability of industrial clusters, and an environmental index, is proposed.

The dissertation analyses ways of development of the circular economy in the High-Tech Zone of Xinyu (p. 103-146). The growth of the economic index over the past decade and the achievement of peak indicators and the decline in the indices of resource provision and environmental protection have been determined. A comparative analysis of the correlation index between the Xinyu Industrial Park and domestic and international industrial parks is carried out. This necessitates the use of benchmarking for the formation of circular clusters in China.

The dissertation considers a benchmarking mechanism to ensure the development of industrial clusters in Xinyu on the basis of the circular economy (p. 149-174). However, problems such as outdated energy structures, over exploitation of resources, legal gaps, imperfect market mechanisms, and low public participation impede the development of the circular economy. To overcome the challenges, the author proposes strategies for a circular economy: government support, technological innovation, market mechanism enhancements, and public education. The system assessment model is crucial for assessing regional circular economy development. On the basis of benchmarking, a new model of the circular economy is proposed (p. 182),

which emphasises resource efficiency and environmental protection for sustainable development, optimisation of resource use, and reduction of pollution.

Scientific novelty of the dissertation results

The main results containing scientific novelty are as follows:

First obtained:

- a methodological approach was developed, reflected through a system of indicators for assessing the development of the regional circular economy for its classification by characteristics in the provinces of China, on the basis of which the spatial distribution of the circular economy was carried out and regions were classified accordingly by the use of China's resources;

- a system of indices for assessing the regional development of circular economy clusters was proposed based on current legislation, regional experience and 35 indicators in three dimensions of "economy-resourceenvironment" (indices of economic production (C1), industrial structure (C2), resource consumption (C3), use (C4), waste disposal (C5) and pollution control (C6), as well as their development paths). On the basis of which, a model for the development of the regional circular economy was developed and an analysis of the evolution of the development path of circular economy clusters was carried out;

Improved:

- the conceptual justification and theoretical positioning of industrial clusters in the circular economy system in the projection of the world benchmarking of the formation of circular clusters;

- the system of interaction between enterprises, industrial parks and the government at the micro-level of regional circular economy development and the method of measuring the degree of development of industrial clusters;

- the system of evaluation of the circular economy of Xinyu Hightech Zone has been 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 of evaluation of resource use indicators;

Further developed:

- the ecological evaluation mechanism of the transformation of Xinyu Hightech Zone towards the rapid development of green, low-tech zones, carbon circular economy, and the achievement of coordinated development of economy and environment;

- the proposal of circular economy development in Xinyu High-tech Zone for planning the industrial chain of the new steel industry of circular economy and the industrial chain scheme of the coal and chemical industry of circular economy based on the correlation index between Xinyu High-tech Industrial Park and domestic and foreign industrial parks;

- the conceptualization of key problems of the implementation and functioning of circular clusters, in particular in the Xinyu High-tech Zone, has been further developed, including the challenges faced by enterprises, parks and the government during the planning and development of the regional circular economy.

Theoretical and practical significance of the results

The dissertation expands the theoretical basis for the study of the regional circular economy by analysing its structure, functions, goals, characteristics, and methods of evaluation. The attention is focused on the functioning of the regional circular economy and models of the circular economy in the context of regional development. It is argued that the circular economy represents a new model of sustainable development, a paradigm shift in technology and economics. The study improves the system of indices for assessing the regional circular economy by analysing the strengths and weaknesses of existing systems from the National Development and Reform Commission, the State Environmental Protection Administration, and the National Bureau of Statistics (macro level) and relevant scholars. A performance assessment framework was created focusing on the

economy, resources, and environment, using principal component analysis 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 identify the main components and increase scientific feasibility through AHP assessment. This method comprehensively assesses the economy, resources, efficiency, and various aspects of the development of a regional circular economy through hierarchical AHP analysis.

The study offers scientific recommendations for strengthening the regional development of the circular economy by evaluating 31 provinces, municipalities, and autonomous regions in China. The study provides insights into the current status of the circular economy in the provinces, helping governments, enterprises, and the public to understand regional circular economy development and offering recommendations for improvement.

Completeness of the dissertation materials in publications

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

Personal contribution of the candidate to the scientific results

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

Assessment of the dissertation structure, language and style of presentation

The dissertation consists of an introduction, three chapters, conclusions, reference, and appendix.

The dissertation is written in business English with a scientific style of presentation of its content, characterised by integrity, semantic completeness, logical sequence of the issues considered, accuracy of the use of special terminology, clarity, clarity and objectivity of the presentation of research materials.

Absence (presence) of violations of academic integrity

The text of the dissertation has been checked for textual borrowings by Turnitin Similarity. According to the results of the check, the absence of textual borrowings without proper reference to the source was revealed and it was established that the dissertation «Benchmarking of the formation of circular clusters» by Zhong Demin are complies with the principles of academic integrity.

Comments on the paper and its discussion points

The disadvantages and discussion points include the following:

1. Needs to indicate evaluative indicators for analyzing the effectiveness of the regional development of circular clusters in China based on benchmark.

2. Needs to describe the advantages for circular clusters formation in China of the following circular economy strategies: government support, technological innovation, market mechanism enhancements, and public education.

3. It would be advisable to detail strategic directions for the introduction of the proposed model of the new circular economy model benchmarking for another Chinese cities.

4. It would be advisable to develop the supportive measures for the system of interaction between enterprises, industrial parks and the government at the micro-level of regional circular economy development in China.

5. The value of the results would have increased if models had been used for compare the case study not only the High-tech Zone in Xinyu City but also another Chinese cities in Chapter 2.

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

Zhong Demin's dissertation on «Benchmarking of the formation of circular clusters» is an independent qualification scientific work, which is performed on an actual topic and solves urgent scientific task. In terms of its content, it corresponds to the speciality 292 - International Economic Relations. The results and conclusions obtained have scientific novelty, important theoretical and practical significance, and make an undeniable contribution to the theory and practice of circular cluster formation.

In terms of scientific level, quality of theoretical and practical developments, structure, style of presentation, 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 Cancellation of the Decision of a One-time Specialised Academic Council of a Higher Education Institution, Scientific Institution on Awarding the Degree of Doctor of Philosophy, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 44 of 12 January 2022, and its author, Zhong Demin, deserves to be awarded the degree of Doctor of Philosophy in the field of study 29 - International Relations, speciality 292 - International Economic Relations.

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