REVIEW
of the official reviewer for the thesis of
Amangeldiyeva Birganym Askarkyzy on the theme «State regulation of the circular economy's development in the Republic of Kazakhstan» presented for the degree of Doctor of Philosophy (PhD)
in the educational program «8D04103 – State and local government».

№	Criteria	Eligibility (one of the options must be checked)	Justification of the official reviewer's position
1.	The topic of the thesis (as of the date of its approval) corresponds to the directions of development of science and/or state programs	1.1 Compliance with priority areas of science development or government programs: **1) The thesis was completed within the framework of a project or target program financed from the state budget (indicate the name and number of the project or program)** 2) The thesis was completed within the framework of another state program (indicate the name of the program) 3) The thesis corresponds to the priority direction of the development of science, approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan (indicate the direction)	The thesis corresponds to the strategic direction of state development programs in the areas of sustainable development, green economy, and environmental governance, as outlined in key national documents and international obligations. The thesis was completed as part of grant-funded scientific projects: 1) AP09259851 – "Development of a circular economy in Kazakhstan: potential, trends, prospects" (2021–2023); 2) AP19576593 – "Responsible production in Kazakhstani enterprises as a tool for achieving SDG 12: assessment of potential and development prospects" (2023–2025). Also, the thesis directly addresses national priorities for a green economy (Decree No. 577, "Concept for Transition to a Green Economy", 2013), carbon neutrality by 2060 (Decree No. 121/2023), and digital transformation ("Digital Kazakhstan"), integrating circular economy principles into state policy and sustainable-development goals.
2.	Importance for science	The work **makes**/does not make a significant contribution to science, and its importance is **well disclosed**/not disclosed.	Amangeldiyeva B.A.'s thesis significantly contributes to science, and its importance is well-disclosed. By advancing an original multi-level regulatory model and synthesizing public administration, economic, legal, and ecological frameworks, the thesis fills a critical gap in both theory and applied policy for circular-economy governance in Kazakhstan. The scientific novelty of the work lies in clarifying the theoretical and conceptual foundations of the circular economy with an emphasis on

			the state's role and in conducting a comparative analysis of international regulatory experience in countries with different income levels. Methodological approaches to assessing the development of the circular economy at the macro, meso, and micro levels were systematized, empirical research tools were developed, and a comprehensive analysis of the readiness of key groups and barriers to implementation was conducted through surveys and expert interviews. Based on the data obtained, practical measures of state support at the macro level and measures at the meso level for the agro-industrial complex were proposed.
3.	The principle of independence	Self-reliance level: **1) High;** 2) Medium; 3) Low; 4) No independence	The dissertation research complied with the generally accepted principles of academic ethics and scientific integrity. The doctoral student independently conducted a comprehensive analysis of the mechanisms of state regulation of the circular economy of the Republic of Kazakhstan at the macro, meso, and micro levels, identified key problems, and developed the author's recommendations for their solution and development. The dissertation clearly maintains a logical structure of the presentation of the material, and the conclusions are presented systematically and reasonably. The author's personal scientific contribution is reflected in the preparation and publication of 12 scientific articles on the topic of the study.
4.	The principle of inner unity	4.1 Justification of the relevance of the thesis: **1) Justified;** 2) Partially justified; 3) Not justified.	The relevance of this study is clear and justified. There is a pressing need to address the existing gaps in government regulation that hinder Kazakhstan's transition to a circular economy, which is essential for achieving Sustainable Development Goal 12 (responsible consumption and production) and overall sustainable development. While strategic goals are outlined in documents such as the "Concept of Transition to a Green Economy" and the "Strategy for Carbon Neutrality by 2060," and others, the practical implementation of these goals faces challenges. These include fragmentation in institutional mechanisms, insufficient financial and tax incentives, and a lack of digital monitoring tools at macro, meso, and micro levels. This thesis aims to analyze and systematize effective regulatory models comprehensively. Additionally, it will develop empirical assessment methods and create recommendations tailored to the Kazakhstani context.
		4.2 The content of the thesis reflects the topic of the thesis: **1) Reflects;**	The content of the dissertation fully reflects the stated topic of state regulation of the circular economy. The first chapter details the theoretical and methodological foundations of the circular economy, substantiates the state's role in creating

		2) Partially reflects; 3) Does not reflect	sustainable models of production and consumption, and includes a comparative analysis of international practice. The second chapter is devoted to the analysis of the regulatory framework of Kazakhstan and an assessment of the current state of development of the circular economy at the macro, meso, and micro levels, including the results of a questionnaire, an expert survey, and interviews to identify barriers in the agro-industrial complex. The third chapter forms practical recommendations for improving public administration: at the macro level - creating a roadmap and a national digital platform, QazaqCircular Hub, and at the meso level - developing eco-industrial parks and introducing IoT and AI technologies. The conclusion provides a rationale for an integrated approach and outlines the directions for further research and implementation of the proposed measures.
		4.3. The purpose and objectives correspond to the topic of the thesis: 1) **correspond;** 2) partially correspond; 3) do not correspond	The purpose and objectives correspond to the topic of the thesis. The purpose of the thesis is a comprehensive analysis of the processes of formation of the circular economy in the Republic of Kazakhstan and the development of substantiated recommendations for strengthening the mechanisms of state regulation that facilitate the transition to the circular development model. To achieve this goal, the following tasks were consistently solved: theoretical and methodological approaches and conceptual apparatus of the circular economy were clarified; a comparative analysis of international experience of state regulation was carried out with the definition of adaptation possibilities in the Kazakhstan context; the methodological foundations for assessing related public policies were studied; the current state of the circular economy in the Republic of Kazakhstan at the macro level was assessed taking into account institutional, regulatory and economic factors; an empirical analysis of the perception and readiness of key groups (population, experts, representatives of the agro-industrial complex) was performed; the main problems, obstacles and institutional constraints were identified; scientifically substantiated proposals for improving macro-level policy measures and practical recommendations for the development of the circular economy in the agro-industrial complex of the Republic of Kazakhstan were developed.
		4.4 All sections and provisions of the thesis are logically interconnected: 1) **completely interconnected;** 2) the interconnection is partial;	The sections of the dissertation are arranged in a single, logically interconnected chain: the introduction formulates the problem, goals and objectives, laying the foundation for the theoretical and methodological analysis in the first chapter; the results and tools of this chapter are directly applied in the assessment of the

		3) there is no interconnection	regulatory framework and empirical research in the second chapter, where key problems and barriers are identified; based on the data obtained, the third chapter offers specific, well-founded recommendations for improving the mechanisms of state regulation at the macro- and meso-levels. Such a step-by-step development of the material - from conceptual understanding to practical measures - ensures the work's complete methodological and narrative integrity.
		4.5 The new solutions (principles, methods) proposed by the author are reasoned and evaluated in comparison with the known solutions: **1) there is a critical analysis;** 2) partial analysis; 3) the analysis does not represent one's own opinions, but quotes from other authors	The work demonstrates a high critical component: the author's conclusions and recommendations are clearly argued and compared with the positions of other researchers in the state regulation of the circular economy. The author does not limit himself to describing the results, but gives her evaluative judgments, comprehensively analyzing each proposed method, from regulatory measures and economic incentives to digital monitoring tools and EIP approaches. A critical analysis identified the weaknesses of the current regulatory mechanisms at the macro, meso, and micro levels and justified the most effective solutions for adaptation in Kazakhstan.
5.	Scientific novelty principle	5.1 Are the scientific results and provisions new? 1) completely new; **2) partially new (25-75% are new);** 3) not new (less than 25% are new)	The work contains a significant share of original provisions (about 25-75%), since the author, for the first time, comprehensively adapted international institutional and regulatory models of circular economy development to the legislative and organizational context of Kazakhstan and substantiated their applicability at the macro, meso, and micro levels. The dissertation also for the first time systematized and tested methodological approaches to assessing circular development at three levels, developed empirical research tools (population and expert surveys, expert interviews), identified determinants and barriers to the transition to a circular economy and proposed the author's support measures - from the creation of a roadmap, a national platform and to the introduction of digital technologies in the agro-industrial complex.
		5.2 Are the thesis findings new? 1) completely new; **2) partially new (25 75% are new);** 3) not new (less than 25% are new)	In her thesis, Amangeldiyeva B.A. partially introduces new scientific provisions (about 25-75%), adapting international models of the circular economy and ESG concepts to the Kazakhstani context, systematizing institutional barriers for the first time and proposing a model for integrating digital monitoring mechanisms into public policy, as well as presenting original empirical data on the determinants of "circular" behavior and practical recommendations for creating eco-parks and

			implementing IoT/AI solutions, which confirms the significant scientific novelty and applied value of the thesis. Some conclusions have been validated through peer-reviewed publications and academic presentations, indicating scholarly recognition and partial novelty.
		5.3 Technical, technological, economic or management decisions are new and reasonable: 1) completely new; **2) partially new (25 75% are new);** 3) not new (less than 25% are new)	The thesis of Amangeldiyeva B.A. proposes several innovative technical and economic solutions that have not been applied in the context of Kazakhstan to date. Firstly, the author develops the concept of circular eco-industrial parks in the agro-industrial complex, which organize the exchange of resources between enterprises, from the supply of by-products to the processing chain to the joint use of energy-efficient technologies. Secondly, a set of IoT sensors and platforms based on artificial intelligence is introduced to monitor the flows of raw materials and finished products in real time, predict bottlenecks, and automatically regulate recycling volumes. Thirdly, the economic model includes dynamic tariffs and incentives for investors to optimize the cost-benefit ratio at all stages of the closed cycle. Finally, a digital platform for transparent accounting of secondary materials and predictive analytics has been developed, which creates the basis for making informed management decisions and minimizing risks. Together, these solutions form a holistic technical and economic package, fully adapted to Kazakhstan's legislative, infrastructural, and socio-economic features, and previously not proposed in domestic practice.
6.	The validity of the main findings	All main conclusions **are**/are not **based** on scientifically significant evidence	The thesis of Amangeldiyeva B.A. ensures high reliability of the findings due to the integrated use of several methods and data sources. All key findings are based on solid empirical data and scientific evidence. The study uses a comprehensive set of methods: a large-scale population survey (n = 3,448) analyzed in SPSS 25, PLS-SEM modeling in SmartPLS 3 with reliability and validity testing of measurement models, and a thematic analysis of expert interviews using coding. This intermethodological approach facilitated a holistic identification of the determinants and barriers to the transition to a circular economy.
7.	The main provisions for the defense	It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?	**Provision 1. A multi-level methodology for assessing the development of a circular economy in the Republic of Kazakhstan has been developed, including a system of indicators at the macro, meso, and micro levels, reflecting institutional, economic, and behavioral aspects.**

		1) proven; 2) rather proven; 3) rather not proven; 4) not proven 7.2 Is it trivial? 1) yes; 2) no 7.3 Is it new? 1) yes; 2) no 7.4 Application level: 1) narrow; 2) medium; 3) wide 7.5 Is it proven in the article? 1) yes; 2) no	7.1 Is the provision proven? **1) proven;** Validated by the conceptual framework (Figure 16), progressive justification, evaluation tools, and practical examples of application. 7.2 Is it trivial? **2) no;** The methodology is original in the context of Kazakhstan's CE assessment. 7.3 Is it new? **1) yes;** The author adapts and applies a layered approach to the national context. 7.4 Application level: **2) medium;** Applicable in both academic and public policy domains. 7.5 Is it proven in the article? **1) not fully.** **Provision 2. It has been established that an increase in costs does not have a statistically significant effect on the level of recycling and reuse of waste, as confirmed by regression analysis, highlighting the importance of intangible factors.** 7.1 Proven? **1) proven;** Supported by regression results (Table 18). 7.2 Trivial? **2) no;** Contradicts common assumptions and expectations. 7.3 New? **1) yes;** Contributes to the discourse on the role of non-financial drivers in CE. 7.4 Application level? **2) medium;** Useful for re-evaluating funding priorities in CE policies. 7.5 Proven in article? **1) yes;** Zhidebekkyzy, A., Temerbulatova, Z., Amangeldiyeva, B. A., & Sakhariyeva, A.

			(2023). Towards a Circular Economy: an Analysis of Kazakhstani case. *Journal of Economic Research & Business Administration, 143*(1), 16–32. **Provision 3. A comprehensive analysis of population and expert surveys allowed for the identification of key determinants of circular behavior and stakeholder readiness.** 7.1 Proven? **1) proven;** Based on over 3,448 respondents, SPSS and SmartPLS 3 were used. 7.2 Trivial? **2) no;** First multi-level behavior analysis of this scope in Kazakhstan. 7.3 New? **1) yes;** Innovative methodological combination of PLS SEM and SPSS. 7.4 Application level? **2) medium;** Relevant for governments, NGOs, and academia. 7.5 Proven in article? **1) yes;** Zhidebekkyzy, A., Moldabekova, A., Amangeldiyeva, B., & Streimikis, J. (2022). Assessment of factors influencing pro-circular behavior of a population. *Economics & Sociology, 15*(3), Article 12. Zhidebekkyzy, A., Moldabekova, A., Amangeldiyeva, B., & Šanova, P. (2023). Transition to a circular economy: Exploring stakeholder perspectives in Kazakhstan. *Journal of International Studies, 16*(3), 144–158. **Provision 4. Based on semi-structured expert interviews with agro-industrial representatives, industry-specific barriers to CE were identified.** 7.1 Proven? **1) proven;** Interviews with experts were analyzed using thematic coding.

			7.2 Trivial? **2) no;** First structured identification of CE barriers in the agri sector. 7.3 New? **1) yes;** Original insights and quotations not previously published. 7.4 Application level? **2) medium;** Applicable to industry specific regulatory programs. 7.5 Proven in article? **1) not fully;** **Provision 5. Practical recommendations were developed to stimulate the circular economy at macro and meso levels, including the introduction of eco-industrial parks for the agro-industrial complex.** 7.1 Proven? **1) proven;** Developed from empirical analysis and expert interviews. 7.2 Trivial? **2) no;** Specific eco park models are novel in this national context. 7.3 New? **1) yes;** Adapted to Kazakhstan's sectoral and institutional specifics. 7.4 Application level? **2) medium;** Can inform government programs by the Ministry of Ecology and Natural Resources and Ministry of Agriculture. 7.5 Proven in article? **1) yes;** Zhidebekkyzy, A., Moldabekova, A., Amangeldiyeva, B., & Streimikis, J. (2022). Assessment of factors influencing pro-circular behavior of a population. *Economics & Sociology, 15*(3), Article 12. Zhidebekkyzy, A., Moldabekova, A., Amangeldiyeva, B., & Šanova, P. (2023).

			Transition to a circular economy: Exploring stakeholder perspectives in Kazakhstan. *Journal of International Studies, 16*(3), 144–158. Zhidebekkyzy, A., Kalmakova, D., & Amangeldiyeva, B. (2022). Implementation of circular economy principles across countries. *Central Asian Economic Review(6)*, 43–62. Zhidebekkyzy, A., Moldabekova, A., & Amangeldiyeva, B. (2023). Pro-environmental behavior and household waste sorting in Kazakhstan: An empirical analysis. *Eurasian Journal of Economic and Business Studies, 67*(1), 39–51.
8.	The principle of reliability Reliability of sources and information provided	8.1 Choice of methodology is justified or the methodology is described in sufficient detail **1) yes;** 2) no	In subsection 1.4, titled "Methodological approaches to assessing and measuring the development of the circular economy," the author identifies and justifies a comprehensive set of methods used in the study. These methods include both quantitative and qualitative approaches, such as theoretical-conceptual and comparative analysis to develop fundamental categories; statistical analysis, including correlation and regression analysis; expert surveys and semi-structured interviews; as well as content and SWOT analysis. Before each empirical section (chapters 2.2–2.4), the author provides detailed descriptions of the objectives, sample composition, data collection tools, and data processing steps. This level of detail ensures transparency in the research process and validity in interpreting results. The tables and methodological diagrams included in the study illustrate a systematic approach and offer clear instructions for replicating the study. According to this, the methodological section adheres to the principle of reliability. The choice of methods is thoroughly reasoned, the stages and tools are described with sufficient detail, and the combination of qualitative and quantitative techniques enables a comprehensive and reliable identification of the determinants and barriers to transitioning to a circular economy in the Republic of Kazakhstan.
		8.2 The results of the thesis were obtained using modern methods of scientific research and methods of	The thesis results were obtained through modern research methods and computer-based tools like SPSS and SmartPLS, ensuring scientific rigor and valid findings. It uses SPSS 25 to process survey data and SmartPLS 3 for structural equation

		processing and interpreting data using computer technologies: **1) yes;** 2) no	modeling (PLS-SEM) to analyze latent variables in the social and administrative sciences. The author combines quantitative methods, such as regression and factor analysis, with qualitative approaches, such as expert surveys and interviews. Diagrams, graphs, and models from SmartPLS, reflecting the use of computer methods for data interpretation, are included.
		8.3 Theoretical conclusions, models, identified relationships and patterns have been proven and confirmed by experimental research (for areas of training in pedagogical sciences, the results have been proven on the basis of a pedagogical experiment): **1) yes;** 2) no	This thesis's theoretical hypotheses and conceptual models were validated using a combined empirical approach. This included a population survey with 3,448 respondents, where data analysis was performed using SPSS 25 (including regressions, determination coefficients R^2, and F-tests) and PLS-SEM modeling in SmartPLS 3 (featuring bootstrapping, Cronbach's α, Composite Reliability, and Average Variance Extracted - AVE). Additionally, expert surveys and interviews were conducted. The statistically significant paths of influence (β, p-values), along with reliability and validity indicators of the measurement models, combined with findings from the interviews, provide a level of "experimental verification" for social research.
		8.4 **Important statements are confirmed** / partially confirmed / not confirmed **by references to current and reliable scientific literature**	All key statements are accompanied by references to modern and authoritative sources: international reports (EU Circular Economy Action Plan - 2020, OECD – 2015, etc), UN SDG, as well as monographs and articles from Scopus / Web of Science and national regulations of Kazakhstan (Concept for the transition to a Green Economy 2013, Environmental Code 2021, etc). At the same time, the literature of the last years forms the basis of the theoretical framework, which guarantees the relevance and reliability of the substantiation of research conclusions. All statements requiring support are accompanied by in-text citations and a well-structured reference list formatted according to international academic standards.
		8.5 **Used literature sources are sufficient**/not sufficient for a literature review	The thesis utilizes over 145 sources, providing a thorough review of the research field and supporting its theoretical and methodological framework. These sources include scientific articles from databases like Scopus and Web of Science, official reports from organizations such as the EU and OECD, as well as national documents from Kazakhstan. The literature review addresses foundational theories of the circular economy and specialized studies on public regulation, institutional economics, ESG, and

			environmental policy. Rather than being a simple compilation, the author evaluates the strengths and weaknesses of different approaches, justifies the chosen theoretical concepts, and identifies the scientific gap the thesis addresses. Most of the cited literature has been published in the last 5 to 7 years, ensuring the study's scientific novelty and relevance to current research trends.
9	Practical value principle	9.1 The thesis has theoretical value: **1) yes;** 2) no	The thesis clarifies and develops the theoretical and conceptual foundations of the circular economy and the state's role, which contributes to enriching the scientific understanding of sustainable development mechanisms. — A systemic methodological model of multi-level assessment (macro, meso, micro) is proposed, which can be used as a basis for further theoretical research in the field of economic regulation. — A comparative analysis of international institutional practices has revealed new principles for adapting regulatory instruments to different economic contexts, thereby expanding theoretical understanding of regulatory flexibility. — The approaches to integrating digital technologies and eco-clusters into the system of public administration of the circular economy developed by the author open up prospects for further theoretical development of "smart" regulation instruments.
		9.2 The thesis is of practical importance and there is a high probability of applying the results obtained in practice: **1) yes;** 2) no	The thesis holds significant practical value, with results applicable in policymaking, public sector planning, and sectoral development, particularly in the agro-industrial sector. The mechanisms for creating eco-industrial parks, digital monitoring via the IoT/AI platform and the dynamic tariff system proposed in the thesis are closely linked to the national strategies, "Concept of the transition to the Green Economy" (2013) and "Carbon Neutrality by 2060" (2023), which ensures support at the level of government bodies. Empirical data from expert interviews show the readiness of relevant ministries and private companies for pilot implementations, and testing of recommendations within the framework of industry programs of the agro-industrial complex indicates the high adaptability of the developed models. All this indicates a real possibility of the practical implementation of the research results in Kazakhstan. Also, in the Appendices I and G of the thesis, there are two Implementation Acts, indicating the use of thesis's results in practice:

			1) JSC "Almaty City Development Center"; 2) LLP "Zhanassyl".
		9.3 Are the practice suggestions new? 1) completely new; **2) partially new (25-75% are new);** 3) not new (less than 25% are new)	The practical recommendations of the thesis are based on the adaptation of international instruments (tax incentives, CE standards, ESG principles) to the Kazakhstan context and include a number of original solutions, from the creation of eco-parks in the agro-industrial complex to the national digital platform QazaqCircular Hub and IoT/AI monitoring. Despite the fact that the key mechanisms are known from foreign practice, their systemic localization and detailed development for the Republic of Kazakhstan are partially new.
10.	The quality of writing and design	Academic writing quality: **1) high;** 2) average; 3) below average; 4) low.	The thesis is written in a clearly structured academic style: logical division into chapters and sections, smooth transitions between them, and each chapter is supported by theoretical and empirical arguments. The concepts and hypotheses are formulated precisely and scientifically; the conclusions are based on data analysis without excessive descriptions. Academic formatting standards are observed (fonts, spacing, structuring of tables and figures, reference formatting). The language of the research is fluent and literate, and terminology in the field of government regulation, sustainable development, and circular economy is used correctly.
11.	Notes on a thesis		The literature review addresses key concepts and international practices; however, it would benefit from a broader analysis of studies conducted in Kazakhstan. Including several recent publications (from 2023 to 2025) would help to contextualize the local realities better. It is important to note that this remark is purely recommendatory and aims to enhance the content; it in no way diminishes the scientific significance or practical value of the research conducted.
12.	Scientific level of the doctoral student's articles on the topic of research (in case of defense of the thesis in the form of a series of articles, the official		The doctoral student has published 12 works, including 2 articles in Q1 journals of the Scopus database ("Assessment of Factors Influencing Pro-Circular Behavior of a Population" and "Transition to a Circular Economy: Exploring Stakeholder Perspectives in Kazakhstan"), 5 articles in journals recommended by the Committee for Quality Control of Science of the Ministry of Education and Science of the Republic of Kazakhstan, as well as the participation in a 1 collective monograph and 4 papers in proceedings of international conferences. The publications are

	reviewers comment on the scientific level of each article of the doctoral student on the topic of research)		methodologically sound, contain original findings, and have been peer-reviewed in leading journals, demonstrating the research's high scientific contribution and sustainability.
13.	Decision of the official reviewer (pursuant to paragraph 28 of the present Model Regulations)		The dissertation of Amangeldiyeva Birganym Askaryzy on the topic "State Regulation of the Circular Economy's Development in the Republic of Kazakhstan" is a completed, independent, and original study, which systematically reveals the current problems of the theory and practice of public administration in the field of circular economy. The work is distinguished by high scientific and practical value, contains partially new provisions adapted to the Kazakhstan context, and fully complies with the requirements of the "Rules for awarding the academic degree of Doctor of Philosophy (PhD)" in the educational program 8D04103 – "State and Local Government". The author deserves to be awarded a PhD degree.

Amangeldiyeva Birganym Askarkyzy's thesis, titled "State regulation of the circular economy's development in the Republic of Kazakhstan", has been completed and is recommended for the award of the Doctor of Philosophy (PhD) degree in the educational program "8D04103 – State and local government".

Reviewer:

Mantas Švažas
PhD, Senior Researcher
Bioeconomy Research Institute
Vytautas Magnus University
Kaunas, Lithuania

We hereby confirm that Mantas Švažas is a Senior Researcher
at the Bioeconomy Research Institute, Vytautas Magnus University

VYTAUTO DIDŽIOJO UNIVERSITETAS
ŽEMĖS ŪKIO AKADEMIJA
AGRICULTURE ACADEMY
UNIVERSITAS VYTAUTI MAGNI

Bioekonomikos tyrimų instituto
direktorius
Rytis Skominas