REVIEW
of the official reviewer for dissertation work
SEITKAN GALIYA GAZIZKYZY
on the theme «Features and Mechanisms of Managing The Formation of Digital Hubs in Kazakhstan»
presented for the degree of Doctor of Philosophy (PhD) in the specialty «8D04105 – Innovation Management».

№	Criteria	Eligibility (one of the options must be checked)	Justification of the position of the official reviewer
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 dissertation 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 dissertation topic is aligned with the priority areas of scientific development in the Republic of Kazakhstan and the objectives of the "Digital Kazakhstan" state program, as well as the Concept of Digital Transformation and Development of the ICT Industry for 2023–2029. The work directly aligns with national strategic guidelines related to digitalization, the innovative economy, and the development of digital hubs, confirming its relevance and practical significance.
2.	Importance for science	The work makes/does not make a significant contribution to science, and its importance is well	This dissertation makes a significant contribution to the development of scientific understanding of digital hub management. Its relevance is well-founded: the author draws on global experience, explores the specifics of Kazakhstan's

		disclosed/not disclosed	reality, and proposes a model for managing digital hubs (D-BEST). The study combines fundamental and applied approaches, laying the scientific foundation for further development of this topic.
3.	The principle of independence	Self-reliance level: **1) High**; 2) Medium; 3) Low; 4) No independence	The author demonstrated a high level of independence. Her comprehensive approach is expressed through the systematic use of analytical methods (correlation-regression analysis, integral indices, SMART PLS-4), the development of her own model, and her own methodological solutions. The research results have been validated at conferences and seminars, confirming the applicant's personal contribution.
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 the topic is fully substantiated. The author convincingly demonstrates the importance of establishing and managing digital hubs for the development of Kazakhstan's digital economy. The work reflects the challenges of the current stage of digitalization, its alignment with strategic programs (Digital Kazakhstan, Digital Transformation Concept 2023–2029), and global trends. Its relevance is supported by regulatory documents, statistics, and practical examples.
		4.2 The content of the thesis reflects the topic of the thesis: **1) Reflects;** 2) Partially reflects; 3) Does not reflect	The dissertation's content is fully consistent with the stated topic. The structure of the study encompasses both the theoretical and methodological foundations of digital hub development and an analysis of the current state of affairs in Kazakhstan, as well as the development of practical recommendations. All chapters and sections address key aspects of the topic, confirming a high degree of consistency between the content and the stated focus of the work.
		4.3. The purpose and objectives correspond to the topic of the thesis: **1) correspond;** 2) partially correspond; 3) do not correspond	The dissertation's purpose and objectives are clearly formulated and directly correspond to the research topic. The goal—developing theoretical and methodological foundations and practical mechanisms for managing digital hubs in Kazakhstan—is realized through a set of tasks, including studying international experience, assessing the digital potential of regions, identifying problems, and developing a proprietary management model (D-BEST). The tasks are

			logically structured and ensure full disclosure of the stated objective.
		4.4 All sections and provisions of the thesis are logically interconnected: 1) completely interconnected; 2) the interconnection is partial; 3) there is no interconnection	All sections of the dissertation are logically interconnected. The work has a clear internal structure: from the problem statement and theoretical framework (Chapter 1), through an analysis of the current state of digital hubs (Chapter 2), to the development of recommendations and a management model (Chapter 3). The introduction, goals, and objectives correspond to the conclusions. Thus, the work demonstrates a high level of internal logic and structural 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 author proposes new solutions—specifically, the D-BEST digital hub management model, a methodology for assessing hub development using a criteria scale, and a system of mechanisms (structural-technological, innovative, investment, institutional, and social). These solutions are substantiated through an analysis of domestic and international experience, compared with existing methods, and supported by empirical data and statistical calculations. The work includes a critical analysis confirming the novelty and significance of the author's proposals.
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 scientific results of this dissertation are partially new. A significant portion of the work is based on the analysis and development of existing concepts of digital hubs, but the author has made an original contribution: he clarified the definition of a "digital hub" from the perspective of innovation management, developed a methodology for assessing the level of hub development using a scale of criteria, and proposed the D-BEST model and a system of management mechanisms adapted to Kazakhstani conditions. Thus, the combination of the theoretical framework and the author's new solutions ensures significant novelty in the study.
		5.2 Are the dissertation findings new? 1) completely new;	The dissertation's conclusions are partially new. The author developed existing approaches to assessing the digital potential of regions and managing digital hubs, but also

		2) partially new (25-75% are new); 3) not new (less than 25% are new)	proposed unique solutions. He identified the impact of ICT spending on hub development, assessed the digital divide in the regions, and proposed mechanisms for eliminating it. The final conclusions are based on previously known approaches but have been significantly expanded and specified for the Kazakhstani context.
		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 technical, economic, and management decisions in the dissertation are partially new. The author creatively adapted international experience and developed applied tools for Kazakhstan: the D-BEST model, a digital hub mapping methodology, and recommendations for implementing management mechanisms. The remainder of the paper draws on existing theoretical developments, but taken as a whole, the solutions are well-founded and have high practical value.
6.	The validity of the main findings	All main conclusions are/are not based on scientifically significant evidence or well-grounded (for qualitative research and areas of training in the arts and humanities)	All the main conclusions of the dissertation are based on compelling scientific evidence and are sufficiently substantiated. The author applied a combination of modern analytical methods: correlation and regression analysis using SMART PLS-4, the integral index method, statistical data processing, as well as empirical research in the form of graduate surveys and an analysis of the activities of existing digital hubs. The conclusions are supported by: – official statistical data from the Bureau of National Statistics; – analytical reports from government agencies and Astana Hub; – results from our own modeling and calculations; – references to international experience and scientific sources. Therefore, the reliability and validity of the conclusions are beyond doubt, and the results obtained have both theoretical and practical value.
7.	The main provisions for the defense	It is necessary to answer the	Provision 1: The author's interpretation of the concept of

		following questions for each provision separately: 7.1 Is the provition proven? 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	"digital hub" in the context of innovation management 7.1 Is the provision proven? – 1) proven 7.2 Is it trivial? – 2) no 7.3 Is it new? – 1) yes 7.4 Application level: – 2) medium 7.5 Is it proven in the article? – 1) yes The author presented a refined definition of the concept of "digital hub" as a center for innovative interaction between government, business, and science (the triple helix). This new perspective expands theoretical understandings of innovation ecosystems. Provision 2: The methodology for evaluating the performance of digital hubs on a five-point scale with defined criteria 7.1 Is the provision proven? – 1) proven 7.2 Is it trivial? – 2) no 7.3 Is it new? – 1) yes 7.4 Application level: – 2) medium 7.5 Is it proven in the article? – 1) yes The author proposed an original methodology for assessing the level of development of digital hubs using a system of indicators and criteria. This tool has not previously been used in Kazakhstani research. Provision 3: The assessment of the digital potential of Kazakhstan's regions using an integral index and identification of digital inequality 7.1 Is the provision proven? – 1) proven 7.2 Is it trivial? – 2) no 7.3 Is it new? – 1) yes 7.4 Application level: – 2) medium 7.5 Is it proven in the article? – 1) yes Based on the integral index, a comprehensive assessment of the digital potential of Kazakhstan's regions was conducted, interregional imbalances were identified, which allowed for

			the formulation of measures to reduce the digital divide. Provision 4: The impact of ICT expenditures on digital hub development indicators (SMEs, research organizations, universities, etc.) 7.1 Is the provision proven? – 1) proven 7.2 Is it trivial? – 2) no 7.3 Is it new? – 1) yes 7.4 Application level: – 2) medium 7.5 Is it proven in the article? – 1) yes The author identified a relationship between ICT expenditures and the development of key digital hub actors (especially SMEs and research organizations). Such calculations have not previously been conducted in the context of Kazakhstan. Provision 5: The D-BEST model and mechanisms (structural-technological, innovation, investment, institutional, social) for managing the establishment of digital hubs in Kazakhstan 7.1 Is the provision proven? – 1) proven 7.2 Is it trivial? – 2) no 7.3 Is it new? – 1) yes 7.4 Application level: – 2) medium 7.5 Is it proven in the article? – 1) yes The author proposes the D-BEST model and a system of management mechanisms adapted to the specifics of the Republic of Kazakhstan. This is one of the key results of the study with practical potential for implementation.
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	1) yes The choice of methodology is thoroughly justified and described in the theoretical and methodological section of the dissertation. The author uses systems and structural approaches, statistical and correlation-regression analysis methods, the integral index method, SMART PLS-4, and MS Excel for data processing. The use of modern scientific tools ensures a high degree of validity of the study.

		8.2 The results of the thesis were obtained using modern methods of scientific research and methods of processing and interpreting data using computer technologies: **1) yes;** 2) no	1) yes Justification: The results of the dissertation were obtained using modern analytical methods and computer technologies: correlation-regression analysis, Z-score data normalization, and economic and statistical methods. The use of application programs (SMART PLS-4, MS Excel) confirms the current level of data processing and interpretation.
		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	1) yes The theoretical conclusions, the original D-BEST model, and the identified relationships and patterns have been confirmed based on an analysis of statistical data from the Bureau of National Statistics of the Republic of Kazakhstan, Astana Hub financial reports, and surveys. Empirical verification ensures the high reliability of the conclusions and the practical significance of the proposed solutions.
		8.4 Important statements are **confirmed** / partially confirmed / not confirmed by references to current and reliable scientific literature	Confirmed All key assertions in the work are supported by references to current scientific literature and regulatory documents. The bibliography includes works by domestic and international researchers, publications in the international Scopus and Web of Science databases, as well as official government documents and strategies.
		8.5 Used literature sources are **sufficient**/not sufficient for a literature review	Sufficient The list of references includes 174 sources, covering a wide range of topics—theoretical works, applied research, international scientific articles, government programs, and concepts. The volume and diversity of sources are sufficient for a comprehensive literature review.
9	Practical value principle	9.1 The thesis has theoretical value: **1) yes;** 2) no	1) yes The dissertation has significant theoretical significance. The work provides a profound theoretical and methodological substantiation of the principles of forming and managing digital hubs, clarifies key concepts, systematizes international

			and domestic approaches, and develops the author's vision of a digital hub as an element of an innovation ecosystem. This expands scientific understanding of digital transformation processes and contributes to the development of innovation management science.
		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	1) yes The dissertation has high practical significance. The mechanisms developed by the author (structural-technological, innovative, investment, institutional, and social), the methodology for assessing the level of digital hubs, and the D-BEST model can be applied in the development of government programs and digitalization strategies. The results of the work have been tested at scientific conferences and in educational settings, and also have potential for implementation in the activities of the Astana Hub and regional digital centers. Furthermore, the materials can be used in university curricula in the fields of "Innovation Management," "Digital Economy," and "Public Administration."
		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)	2) partially new (25–75% are new) The practical suggestions in the dissertation are partially new—approximately 70–75%. Some of the recommendations are based on the synthesis and adaptation of international experience, but the work also includes original solutions: the proprietary D-BEST model, a methodology for mapping digital hubs in Kazakhstan's regions, and adapted mechanisms for managing digital ecosystems. These proposals take into account Kazakhstan's specifics and can be implemented in regional policy, confirming their practical significance and originality.
10.	The quality of writing and design	Academic writing quality: 1) high; 2) average; 3) below average; 4) low.	1) High The quality of the academic writing in the dissertation is high. The text is characterized by logical coherence, coherence, and a well-reasoned presentation of the material. The conceptual framework used complies with academic standards and the requirements for dissertation research.

			The presentation is scholarly, and the dissertation structure is methodologically rigorous, ensuring the integrity of the scientific text. The illustrative and tabular materials are formatted correctly and in accordance with established standards. The work demonstrates a high level of analytical elaboration, depth of theoretical analysis, and the reliability of the presented results. This confirms that the dissertation meets the high standards of academic writing.
11.	Notes on a thesis	The dissertation is a holistic, relevant, independent, and completed scientific study. Alongside its significant merits, it is necessary to highlight several remarks which can be considered as directions for further research development: 1. Although the dissertation provides a comprehensive analysis of the problems of managing the establishment of digital hubs and proposes effective mechanisms, it would be advisable to more fully reflect quantitative indicators of the expected efficiency of the suggested measures. For example, scenario modeling, calculation of potential economic effects, or comparative analysis "before and after" implementation of the proposed tools could significantly strengthen the empirical justification of the conclusions and enhance the practical value of the research for state policy development in the sphere of digital transformation. 2. The proposed D-BEST model and system of mechanisms for managing digital hubs are well-grounded and adapted to the Kazakhstani context. At the same time, it would be useful to expand the comparative analysis of the suggested model with similar approaches applied in other countries, especially in transition economies. Such an analysis could additionally confirm the competitiveness of the author's solutions and demonstrate their adaptability to various institutional environments. In general, the mentioned remarks do not reduce the merits of the dissertation, which demonstrates a high theoretical and practical level, and represent only recommendations for further deepening of research.	
12.	Scientific level of the doctoral student's articles on the topic of research (in case of defense of the dissertation in the form of a series of articles, the official reviewers comment on the scientific level of each article of the doctoral student on the topic of research)	The main provisions and results presented for defense are reflected in 11 scientific publications. Among them is an article published in the international peer-reviewed Journal of Distribution Science, indexed in the Scopus database (Q3), with a 39th percentile in the subject area Economics, Econometrics and Finance. Six publications have been issued in journals recommended by the Committee for Quality Assurance in the Field of Science and Higher Education of the Republic of Kazakhstan, which confirms their academic significance at the national level. The remaining papers were presented and published in the proceedings of international and	

		national scientific-practical conferences, which demonstrates recognition of the research results in the academic community and highlights their applied relevance. Thus, the published results confirm the scientific validity of the dissertation research and reflect both national and international recognition of the studied topic.
13.	Decision of the official reviewer (pursuant to paragraph 28 of the present Model Regulations)	Based on the analysis of the content of the dissertation "Features and Mechanisms of Managing the Formation of Digital Hubs in Kazakhstan", the level of scientific results, the degree of novelty and practical significance, as well as the compliance of the dissertation with the requirements for scientific qualification works, I conclude that this dissertation fully meets the criteria specified in the "Rules for the Awarding of Degrees." Its author, Seitkan Galiya Gazizkyzy, fully deserves the awarding of the degree of Doctor of Philosophy (PhD) in the educational program 8D04105 – Innovation Management.

Official Reviewer:
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