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MECHANISMS OF HUMAN CAPITAL CAPACITY MANAGEMENT OF HIGHER EDUCATION SYSTEM OF KAZAKHSTAN IN THE CONTEXT OF GREEN TRANSITION

Dissertation for the degree of Doctor of Philosophy (PhD) in the educational program 8D04101 - «Management»

ANNOTATION

Relevance of the research topic. The relevance of the research is due to the growing global and national challenges associated with the transition to sustainable development and decarbonization of the economy. According to the World Economic Forum, 47% of employers plan to transform their business models amid the transition to a green economy, and about 39% of employees' key professional skills will change or lose relevance by 2030. Such trends indicate an increasing need for specialists with environmental, digital, analytical, and interdisciplinary competencies who can adapt to structural and technological changes in the economy. In addition, according to the United Nations Development Program, Kazakhstan ranks 60th among 193 countries and territories on the Human Development Index, which has a value of 0.837, and belongs to the group of countries with a very high level of human development. At the same time, the acceleration of technological modernisation, changes in the employment structure and the transition to a low-carbon development model are creating new requirements for the quality, adaptability and competitiveness of human capital. Under these conditions, its development is becoming one of the key factors for sustainable economic growth and the successful implementation of green transformation.

Kazakhstan, as a country with a high dependence of the economy on the raw materials sector, actively integrates the principles of sustainable development into its national economic policy. The priorities of environmental modernisation, increasing energy efficiency, developing renewable energy sources, and reducing the carbon intensity of the economy are set out in the Concept for the Transition of the Republic of Kazakhstan to a "green economy" and the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan until 2060. The implementation of these priorities requires a transformation of the structure of the economy and the labour market, which, in turn, creates an increased demand for new-quality human capital with environmental, digital and interdisciplinary competencies. In this regard, the higher education system is of great importance as a key institutional mechanism for the formation, development and reproduction of human capital. Modern universities should not only perform an educational function but also act as centres for knowledge generation, scientific research, innovation, and training of personnel capable of developing and implementing solutions in the field of the rational use of natural resources, the reduction of environmental risks, and sustainable development. All this requires a corresponding transformation of

educational programs, research activities, organisational culture and human capital capacity management mechanisms of higher education organisations.

The need to modernise the higher education system and develop human capital is enshrined in the strategic documents of the Republic of Kazakhstan. The Message of the President of the Republic of Kazakhstan, K. Tokayev, dated September 8, 2025, "Kazakhstan in the era of artificial intelligence: current challenges and their solutions through digital transformation", emphasises that the development of human capital is a key factor for competitiveness and sustainable growth. The relevant priorities are also reflected in the Concept of Transition of the Republic of Kazakhstan to a "green economy" for 2021-2030, the Strategy for Achieving Carbon Neutrality until 2060, as well as in the Concept of Development of Higher Education and Science of the Republic of Kazakhstan for 2023-2029, which provides for the modernization of educational programs and strengthening their integration with the economy. In general, these regulatory legal acts and government policy can be considered the institutional basis for the transformation of the higher education system and the development of human capital, with a focus on the requirements of the "green" economy.

At the same time, the existing mechanisms for managing the human capital of higher education institutions are insufficiently focused on the systematic development of green competencies, the integration of sustainable development principles into universities' personnel and educational policies, and the readiness of academic staff for environmental and technological transformations. There is still a need to coordinate university development strategies, professional development mechanisms for employees, motivation systems and performance assessment with the objectives of the transition to a green economy. Thus, the relevance of the dissertation research is determined by the contradiction between the increasing need of the Kazakh economy for human capital capable of ensuring green transformation and the lack of comprehensive management mechanisms for its formation and development in the higher education system. The solution to this scientific problem involves developing organisational and managerial mechanisms to foster green competencies, enhance the adaptability of academic staff, and strengthen universities' contribution to achieving sustainable development goals.

The degree of scientific development. The issues of formation, development and effective use of human capital have been widely covered in economic theory, management, higher education research, innovative development and sustainable transformation. At the same time, human capital capacity management in higher education institutions in the context of the transition to a green economy is an interdisciplinary field at the intersection of several scientific approaches.

The theoretical foundations of human capital research were laid in the works of T. W. Schultz, G. S. Becker, J. Mincer, R. R. Nelson, E. S. Phelps, Y. Ben-Porath, G. Psacharopoulos, R. E. Lucas, P. M. Romer, R. Stehle, in which human capital was considered as the result of investments in education, vocational training and health, which determines labor productivity, employee incomes, social and economic development. In the research by R.R. Nelson, E. S. Phelps, R. E. Lucas, and P. M. Romer, human capital has been further developed as a factor in

technological progress, innovation, and long-term economic growth. However, classical economic models mainly focus on assessing the volume of investment and the economic returns from education and, to a lesser extent, on revealing organisational mechanisms for managing the qualitative characteristics of universities' human capital. Further, the organisational and managerial approach to the study of human capital is presented in the works of C. Argyris, D. A. Schön, I. Nonaka, H. Takeuchi, L. Edvinsson, M. S. Malone and N. Bontis. In this area, human capital is considered a strategic resource of the organisation and an integral part of intellectual capital. In relation to higher education, the university was considered as a learning and knowledge organisation that ensures the production, dissemination and practical application of knowledge.

The role of universities in the formation of innovative ecosystems is revealed in the research of H. Etzkowitz, L. Leydesdorff, B. Bozeman, M. Wright, P. C. Boardman, A. Faggian, P. McCann and R. Florida. In these works, universities are considered not only as educational organisations, but also as participants in the innovative interaction of the state, business and the scientific community. Researchers have substantiated the role of universities in the creation and commercialisation of knowledge, the development of entrepreneurial activity, the formation of regional human capital and increasing the innovation potential of territories. A separate area of research is related to the development of adaptive, digital, entrepreneurial and interdisciplinary competencies. In the works of J. R. Abel, R. Deitz, T. Johansen, T. Karlsson, C. Wigren, M. R. Marvel, A. A. C. Teixeira and a number of other researchers, human capital is considered as a dynamic set of knowledge, skills and abilities, changing under the influence of technological, institutional and structural transformations. This approach reflects the transition from a predominantly static understanding of human capital to a process approach, according to which competencies must be continually updated through learning, professional development, and organisational change.

In recent years, a scientific field has been actively developing, dedicated to green human capital, green competencies, and the role of education in achieving sustainable development goals. In the works of W. Ma, S. Yu, T. Yuizono, H. Yao, X. Gu, A. Hrebenciuc, A. Bazrkar, A. Sudolska, G. Chaberek, J. Ziolkowska, G. Al-Zohbi, M. A. E. Pilotti, Z. S. Younis, S. Menon, M. Suresh and other researchers address the issues of developing green skills, greening educational programs, implementing ESG principles, shaping environmentally responsible behaviour, and transforming universities into sustainable institutional systems. These studies confirm that a successful transition to a green economy depends not only on technological and financial resources, but also on the availability of specialists with relevant knowledge, values and competencies.

The Kazakhstani scientific literature explores issues of human capital development, modernisation of higher education, improvement of the quality of specialist training, development of university science, and the formation of competencies that meet the needs of the national economy. These issues are reflected in the works of K. A. Sagadiyev, L. S. Spankulova, G. Rakhimzhanova, O. Adilkhanov, D. Jonbekova, G. Berdykulova and other Kazakhstani researchers. At

the same time, studies directly devoted to the mechanisms for managing green-oriented human capital in higher education institutions in Kazakhstan are limited.

The analysis of the scientific literature shows that a huge amount of theoretical and scientific-practical material has been accumulated, revealing the economic, organisational, institutional, innovative and competence aspects of human capital. However, existing studies mainly consider these aspects separately. Comprehensive approaches that combine strategic human capital capacitymanagement of universities, the development of green competencies, organisational mechanisms for professional development and sustainable transformation tasks have not been sufficiently developed. In addition, the scientific literature lacks a unified methodological approach to assessing the green-oriented human capital of higher education organisations, the factors of its formation have not been sufficiently studied, and the mechanisms of interaction between the state, universities, employers, and the academic community in the process of developing relevant competencies have not been fully defined.

Thus, the scientific gap lies in the insufficient theoretical and methodological elaboration of integrated management mechanisms for the formation and development of green-oriented human capital in higher education institutions in Kazakhstan. The need to eliminate this gap determines the direction of the dissertation research and involves the development of an appropriate assessment methodology, a system of organisational and managerial mechanisms and practical recommendations for universities and government agencies.

Research aim and objectives. The aim of the dissertation is to substantiate the theoretical and methodological foundations of human capital capacity management in Kazakhstan's higher education system and to develop mechanisms for strengthening human capital capacity in the context of the green transition.

To achieve this aim, the following **objectives** are being solved:

– to analyse the evolution of theoretical approaches to human capital capacity management in the higher education system;

– to systematise the international experience of managing higher education systems in the context of the green transition and identify best practices applicable in the national context;

– to substantiate methodological approaches to human capital capacity management of the higher education system of Kazakhstan, considering the principles of sustainable development;

– to analyse the current state and level of development of the higher education system in Kazakhstan;

– to assess the structure, quantitative and qualitative characteristics, as well as trends in the development of human capital in the higher education system of Kazakhstan;

– to identify the key problems and limitations of human capital capacity management in the higher education system in the context of the green transition;

– to identify promising areas for the transformation of human capital capacity management in higher education in the context of the green economy;

– to develop an integrated approach to managing the development of human capital in the higher education system;

– to form and substantiate a system of mechanisms for improving the human capital capacity management of the higher education system of Kazakhstan in the context of the green transition.

The subject of the research is the organisational and managerial relations and mechanisms for the formation and development of human capital in higher education organisations in Kazakhstan in the context of the transition to a green economy.

The object of the research is the human capital of higher education institutions of the Republic of Kazakhstan.

Research methods. The methodological basis of the dissertation research is a mixed-methods approach combining quantitative and qualitative methods. The application of this approach has made it possible to comprehensively study the state of human capital in higher education organisations in Kazakhstan, the factors driving its development, and the management mechanisms in the context of the transition to a green economy.

The following methods were used in the research process:

– bibliometric analysis of publications used to identify the dynamics of scientific interest in the problems of human capital of universities, green competencies and sustainable development of higher education, identify key authors, thematic areas and clusters of scientific knowledge; bibliometric maps were built using VOSviewer software;

– a systematic review of scientific literature conducted in accordance with the recommendations of PRISMA 2020, which ensured a consistent search, selection, filtering and meaningful systematisation of publications on human capital capacity management, sustainable development and the green transformation of higher education;

– an international comparative analysis used to compare human capital capacity management models and practices for the development of green competencies in foreign higher education systems, as well as to identify opportunities for their adaptation to the conditions of Kazakhstan;

– methods of descriptive and comparative statistical analysis used to study the dynamics and structure of indicators of the development of the higher education system, academic qualifications, scientific performance, professional development and incentive mechanisms for teaching staff;

– correlation analysis used to identify the direction and closeness of the relationships between academic performance indicators, the use of a system of key performance indicators and mechanisms for material and non-material incentives for employees of higher education institutions; statistical data processing was performed using software packages SPSS and R;

– a sociological survey of the teaching staff of higher education institutions in Kazakhstan, which allowed us to obtain primary empirical data on professional characteristics, academic performance, institutional support, motivation system and employees' readiness for structural and competency-based changes;

– expert interviews with representatives of the academic community and management staff of higher education institutions aimed at identifying institutional barriers, management constraints and opportunities for human capital development in the context of green transformation; the interview materials were processed using thematic coding using Nvivo software;

– PEST analysis used to assess the impact of institutional, economic, social, and technological factors on the development of the higher education system and human capital capacity management mechanisms;

– scenario analysis used to develop alternative trajectories for the development of human capital in higher education institutions, taking into account possible institutional, technological, social, economic and environmental changes.

The integrated application of these methods provided a consistent combination of theoretical, statistical and empirical analysis and allowed us to develop practical recommendations for improving the human capital capacity management mechanisms of higher education institutions in Kazakhstan in the context of green transformation.

The empirical research design includes two complementary analytical levels. The first, quantitative level, aims to assess the state and dynamics of the human capital of higher education organisations and to identify relationships among academic performance, professional development, the effectiveness assessment system, and incentive mechanisms for teaching staff. The second, qualitative level, is aimed at studying the requirements of green transformation for the competencies and human capital capacity management system of universities.

The study considers the transition to a green economy as an institutional and strategic context that introduces new requirements for the professional, environmental, digital, and interdisciplinary competencies of academic staff. Its substantive characteristics are investigated through analysis of scientific literature, international experience, expert assessments, and scenarios for the transformation of the higher education system.

The information and empirical base of the study was made up of official statistical data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan for the period from 2000 to 2024, characterising the state and dynamics of the development of the higher education system, employment and the structure of human capital. The study also uses data from international ratings and analytical databases, including QS and THE, reflecting the positions of Kazakhstani universities in terms of scientific activity, publication effectiveness, citation, academic reputation, international cooperation and competitiveness. Additional sources of information included regulatory legal acts of the Republic of Kazakhstan, strategic documents in the fields of higher education, human capital development, sustainable development, and the transition to a green economy, as well as scientific publications indexed in the Scopus and Web of Science databases.

The empirical basis of the study was the results of a sociological survey of 958 representatives of the teaching staff of 32 organisations of higher education in Kazakhstan. The survey aimed to assess the professional and qualification

characteristics of academic staff, the effectiveness of scientific and educational activities, the availability of professional development and institutional support, the incentive mechanisms used, and employees' willingness to adopt competency-based changes driven by green and technological transformation.

The quantitative data were supplemented by results from 12 expert interviews with representatives of the academic community, managers and administrative staff of higher education organisations, and specialists in sustainable development. Expert interviews enabled the identification of institutional and organisational barriers, the assessment of the need to develop green competencies, the assessment of universities' readiness to integrate the principles of sustainable development, and the clarification of promising mechanisms for managing human capital in the context of the transition to a green economy.

The combination of official statistical, rating, sociological, and expert data provided an opportunity for a comprehensive assessment of the state of human capital in higher education organisations in Kazakhstan and to substantiate areas for improving management mechanisms for its formation and development.

Scientific novelty. The scientific novelty of the dissertation research lies in the development of theoretical and methodological provisions and an integrated approach to managing green-oriented human capital in higher education organisations in Kazakhstan. During the research, the following scientific results were obtained, which have elements of scientific novelty:

- the theoretical approaches to human capital capacity management of the higher education system are systematised, and the main stages of their evolution (classical, institutional, innovative, competence-adaptive and modern) are highlighted;
- the management models of the higher education system in the context of the "green" transition are systematised;
- a comprehensive combination of macro-indicator analysis, sociological data and correlation analysis was applied, which made it possible to identify the factors determining the scientific productivity of academic staff and the effectiveness of incentive mechanisms in universities;
- a multilevel model of interaction on the implementation of mechanisms for the development of human capital in higher education institutions is proposed;
- the conceptual basis of the policy of modernisation of the higher education system aimed at developing the potential of human capital is substantiated.

The main provisions submitted for defense:

– the author's interpretation of the term “green-oriented human capital in universities” refers to the accumulated knowledge, professional skills, interdisciplinary competencies, environmental values and behavioural capabilities of students, academic staff, researchers and administrative personnel that enable them to contribute to a sustainable, low-carbon and resource-efficient economy;

– a typology of management models of the higher education system in the context of a green transition, taking into account differences in the institutional environment, the level of centralisation, and mechanisms for integrating the principles of sustainable development;

– a combined methodology for assessing the factors of scientific productivity and the effectiveness of human capital capacity management at universities, based on the integration of statistical, sociological and correlation analysis, which allows for the identification of the relationship between indicators of publication activity, institutional conditions and the effectiveness of the incentive system for academic staff;

– human capital capacity management mechanisms of the higher education system in the context of the green transition, including institutional, educational, managerial, infrastructural, digital and social tools ensure the integrated development of the human capital of universities;

– a roadmap for the modernisation of human capital capacity management at universities in the context of a green transition, reflecting a phased transformation based on the consistent formation of environmental, digital, managerial and transformational competencies.

The theoretical significance of the study. The theoretical significance of the dissertation research lies in the development of theoretical and methodological principles for human capital capacity management in the higher education system in the context of the green transition. The paper systematises and integrates modern theoretical approaches to the analysis of human capital, thereby forming a holistic theoretical basis for the study. The proposed interpretation of green-oriented human capital and the developed conceptual approach to its development in the higher education system advance scientific understanding of universities' role as key institutions in the formation of human capital focused on achieving sustainable development goals. The results obtained also contribute to deepening theoretical research in the fields of educational economics, university management, and the sustainable transformation of social and economic systems.

Theoretical provisions, the research results can be used in the educational process in the preparation of students in the educational programs "Management", "Economics", "Human Resource Management", "State and local government", as well as in teaching the disciplines "Management in higher education", "Green Economy" and other related disciplines in higher education institutions. education of the Republic of Kazakhstan.

Practical significance of the research. The practical significance of the research lies in the potential to use the results to improve human capital capacity management mechanisms in Kazakhstan's higher education system in the context of the green transition. The managerial and institutional mechanisms developed in the dissertation to form green-oriented human capital can inform state policy in higher education, university development strategies, and educational modernisation programmes. The proposed practical recommendations aim to develop the green competencies of students and teachers, integrate ESG principles into the university management system, improve the mechanisms for the professional development of academic staff, and increase the competitiveness of Kazakhstan's human capital in the context of the transition to a sustainable economy.

Approval and implementation of research results. The main results of the dissertation research have been published in 22 scientific papers, including articles

in international peer-reviewed scientific journals indexed in the Scopus - 6, publications in scientific journals recommended by the Committee for Quality Assurance in Science and Higher Education of the Republic of Kazakhstan - 3, as well as in domestic journals and international materials scientific and practical conferences - 13.

The structure and scope of the dissertation. The dissertation consists of an introduction, three chapters, a conclusion, a list of sources used, and appendices. The total volume of the dissertation is 195 pages, including 23 tables, 21 figures and 4 appendices. The list of sources used includes 287 titles.