ANNOTATION

of dissertation by Sabina Karzhaubaykyzy Seidaliyeva entitled "Improving Foresight Management in the Development of Medical and Pharmaceutical Clusters", submitted for the degree of Doctor of Philosophy (PhD) under the 8D10140 — Pharmacy educational programme

Relevance of the research topic. Few issues are currently more pressing than the present situation and the future direction of Kazakhstan's pharmaceutical industry. The industry is developing rapidly. According to most market participants (51%), further growth of 5–10% is expected over the next one to two years, driven mainly by the retail segment. This growth is partly attributable to the State's commitment to expanding medicine provision for socially significant diseases and supporting domestic manufacturers. Investment is shifting from distribution towards research and development, creating new challenges for the national pharmaceutical industry, including the establishment of medical and pharmaceutical clusters. Despite the financial growth of the pharmaceutical market, physical consumption declined by 12.5%. This indicates that the growth was inflation-driven and that foresight is essential for the genuine development of clusters.

Experience from countries near and far abroad shows that medical and pharmaceutical clusters can accelerate biomedical research and commercialisation; expand R&D capacity by concentrating advanced equipment and facilities within clusters and providing shared access to them; and increase investment in joint R&D projects by cluster participants. Achieving these benefits, however, requires conditions that enable effective interaction among cluster participants and sustainable cluster development. Competent human-resource management in participating organisations—namely, foresight management—is one of the principal factors affecting cluster success.

Foresight is a field of practice and theory undergoing substantial development; over recent decades it has evolved into a diverse set of methods, processes and objectives. Foresight methods are often described as technology assessment or strategic intelligence methods. Foresight may be defined as a systematic, future-oriented, analytical and interactive process that contributes to a shared vision of long-term development in science, technology, business and society and aligns relevant stakeholder groups around desired development goals through appropriate strategies, decisions and actions [2].

Today, enterprises mainly use foresight methods to support strategic decision-making. Foresight is also applied to improve long-term planning, provide early warning of complex situations (issue management), strengthen learning and innovation processes, and enhance the overall capacity to respond to changes in the strategic environment [3].

It is therefore particularly relevant to apply foresight to management in organisations participating in medical and pharmaceutical clusters. The need to study foresight management of pharmaceutical personnel within such clusters arises because effective integration of different enterprises requires a new approach. This calls for reconsidering pharmaceutical human-resource management on the basis of theoretical and methodological approaches. Improving foresight management in

pharmacy will thus build on the existing personnel-management system and is especially important and timely.

Research aim: To develop theoretical and methodological approaches to improving foresight management in the development of medical and pharmaceutical clusters.

Research objectives:

1. To examine the history and organisation of medical and pharmaceutical clusters through a literature review;
2. To develop a methodological approach to diagnosing foresight management in the development of medical and pharmaceutical clusters;
3. To develop a new approach to the effective performance of medical and pharmaceutical cluster personnel;
4. To develop a methodological approach to evaluating the effectiveness of a medical and pharmaceutical cluster;
5. To develop a model for ensuring the sustainable development of a medical and pharmaceutical cluster, including its organisational structure, criteria, composition and functions of its elements;

Research object: the pharmaceutical sector of the Republic of Kazakhstan as a socio-economic system undergoing structural transformation.

Research methods: A set of complementary methods was used, including systems and comparative analysis, content analysis of educational programmes, sociological survey, analysis of sectoral and statistical data, descriptive and multivariate statistics (Pearson's χ^2, Cramér's V, Pareto analysis, exploratory factor analysis and binary logistic regression), as well as foresight-management tools.

Research subject: Organisational and managerial relations, methodological approaches and tools for implementing foresight management aimed at improving human-resource capacity and ensuring the sustainable development of the medical and pharmaceutical cluster.

Scientific novelty of the research

1. For the first time, a scientific and methodological approach to developing human resource capacity in the pharmaceutical industry of the Republic of Kazakhstan has been proposed to address the identified gap between specialists' actual and required professional competencies. As part of this approach, a "Pharmacist Manager" occupational profile was developed and included in the draft "Pharmaceutical Activities" professional standard. Proposals for its use in updating educational programmes for pharmaceutical personnel were also substantiated.

2. For the first time, a mathematical model for calculating the Cluster Efficiency Index (CEI) has been developed. The model enables quantitative assessment of normalised gaps (gapj) between the target and actual values of key cluster performance indicators, identification of critical areas of deviation, and timely adjustment of management strategies.

3. For the first time, an integrated foresight model for the sustainable development of a medical and pharmaceutical cluster has been developed. Based on the priority role of human resource capacity, it combines diagnosis of the current situation, scenario forecasting, anticipatory management mechanisms and cross-

sectoral interaction within a single system for formulating and implementing strategic decisions.

Main propositions submitted for defence:

1. Formulation of theoretical and methodological approaches to diagnosing foresight management in the pharmaceutical industry of the Republic of Kazakhstan.

2. Scientific substantiation of improvements in pharmaceutical personnel training in accordance with the current and prospective workforce and market needs of the pharmaceutical industry of the Republic of Kazakhstan.

3. Development of the “Pharmacist Manager” occupational profile within the “Pharmaceutical Activities” professional standard and identification of its potential applications within the professional qualifications system and the education and training of pharmaceutical personnel.

4. Creation of an integrated foresight model for the sustainable development of a medical and pharmaceutical cluster, ensuring its adaptability and preparedness for global challenges.

Practical significance of research:

The proposed methods enable participants in the medical and pharmaceutical cluster to identify staffing needs, develop training plans for personnel, coordinate joint projects, and monitor the effectiveness of their collaboration.

Proposals for updating the professional profile of a "pharmacy manager" and a curriculum for a "pharmacy management" course are intended to enhance the professional training and continuing education of pharmaceutical specialists. The CEI methodology can serve as an additional analytical tool for evaluating cluster performance, provided that sufficient baseline data is available.

The methodological recommendations and the roadmap establish a foundation for the systematic integration of workforce foresight into the management practices of organizations. Specific findings from the research have been implemented within the operations of the "Kazakhstan Center for Industry and Export 'QazIndustry'" JSC and the pharmaceutical company "Ecopharm," as evidenced by formal implementation records.

Furthermore, the results and key tenets of this dissertation research can be utilized in the development of elective courses for academic programs in the field of pharmacy.

Publications on the dissertation topic:

Scientific works reflecting the main content of the dissertation have been published, including:

2 articles in international scientific journals indexed in Scopus, including 1 article in a second-quartile (Q2) journal and 1 article in a third-quartile (Q3) journal;

2 articles in a scientific journal recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan;

7 works in the proceedings of international scientific and practical conferences.

One set of methodological recommendations was published, and two certificates of entry in the State Register of Rights to Copyright-Protected Objects

were obtained (№ 55943, № 77723).

Conclusion

The dissertation addresses an applied scientific task involving the development of theoretical and methodological approaches and practical foresight-management tools aimed at the sustainable development of the medical and pharmaceutical cluster of the Republic of Kazakhstan.

The findings support the following main conclusions corresponding to the research objectives.

1. An analysis of international experience in the United States, the United Kingdom, Australia, and India reveals that, in the context of global macroeconomic instability, the classical "triple helix" model does not fully account for the specificities of the pharmaceutical sector. It is argued that a transition to a "quadruple helix" model of innovation is appropriate, wherein the clinical environment and society—including patients—serve as the fourth foundational element. Their involvement facilitates the collection of Real-World Data (RWD), which is essential for the development and efficacy assessment of innovative medicinal products.

2. A comprehensive assessment of the current state of the pharmaceutical market in the Republic of Kazakhstan was conducted. A divergence was identified between market dynamics in monetary terms and in physical volume; as of the end of 2025, the shares of domestic products stood at 14.9% in monetary terms and 32.3% in physical volume. A survey of 405 professionals helped identify key human resource barriers, the need for developing both professional and transferable (soft) skills, and the necessity for improved coordination among cluster participants. By synthesizing market and human resource data, the study establishes a framework for enhancing foresight management, effectively linking the industry’s long-term objectives with the training of specialists.

3. A new approach to developing human capital within the pharmaceutical industry has been devised. To bridge the identified competency gap, the professional profile for a "Pharmaceutical Manager" has been updated, with proposals formulated for its integration into the professional qualification system and educational curricula for pharmaceutical personnel (a working group was established by the Educational and Methodological Association/Council on February 17, 2023; Minutes No. 3). As part of the development of a "high-skills ecosystem," a specialized 300-hour certification course has been created (approved by the Educational and Methodological Association (EMA RUMS) for the field of study "Healthcare" on June 13, 2024; protocol No. 8).

4. A methodology for the integral assessment of the efficiency of a medical-pharmaceutical cluster has been developed. To quantify the quality of integration processes, a system of indicators has been proposed, grouped into five categories: innovation, production, cooperation, human resource potential, and economics. A mathematical model for calculating the Cluster Efficiency Index (CEI) has been developed; it allows for the identification of normalized gaps (gapj) between target and actual indicator values, providing a basis for the timely adjustment of management strategies.

5. An integrated foresight management model for a medical-pharmaceutical cluster has been developed, combining organizational, human resource, and information-analytical tools to align the future priorities of its participants. Three development scenarios—inertial, baseline, and target—have been formulated, extending to 2030. Using a backcasting (reverse forecasting) method, it was determined that transitioning from a 14.9% value-based share of domestic products in 2025 to a target level of 50% by 2029 requires an average annual relative growth rate of approximately 35.3%. This calculation illustrates the dynamics necessary to reach the target, rather than the quantitative impact of implementing the model itself. For practical implementation, a phased roadmap for 2026–2030 has been proposed, covering organizational and methodological preparation, the development of human resource mechanisms, and the establishment of information-analytical support.