REPUBLIC OF AZERBAIJAN

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ABSTRACT
of the dissertation for the degree of Doctor of Science

IMPROVING THE STATE REGULATION OF THE FORMATION OF THE KNOWLEDGE ECONOMY IN AZERBAIJAN

Specialty:	5308.01 – "General Economics"
Field of Science:	53 - Economic Sciences
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Baku – 2025

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Introduction

Relevance of the topic and degree of study: The production, dissemination, assimilation, and application of knowledge (hereafter – development of knowledge) form the foundation of every country's socio-economic, military-political, as well as technical-technological progress. Therefore, the development of knowledge and the strengthening of its driving impact on the economy rank among the strategic goals of states. Especially in the modern period of the rapidly accelerating "4th Industrial Revolution" (4IR), the regulation of the acceleration of knowledge development is particularly relevant.

The regulation of knowledge development and increasing its role in economic development (the knowledge economy) depends on the level of various economic and non-economic macro factors such as the business environment, trust, institutions, infrastructure, property rights, competitive markets, the integrity of the state, rule of law, etc. At the same time, a critical role in forming the knowledge economy is played by the formation of a class of innovative entrepreneurs in the country, the level of coordinated regulation of the sectors directly involved in knowledge development – education, science, and information (ESIS), their interaction with macro factors, human capital, innovation-investment activity, and the efficiency of the mechanism for regulating knowledge development. The knowledge economy (KE) is an economy in which knowledge is the primary driving force of socio-economic development. Building such an economy requires knowledge, innovation, capital, human capital, and effective institutions.

In recent years, a number of important documents aimed at the development of knowledge and innovation have been adopted in Azerbaijan. By the Decree of the President of the Republic of Azerbaijan Ilham Aliyev dated December 6, 2016, the "Strategic Roadmaps for the National Economy and main economic sectors" were approved in 10 directions; by the Order dated February 2, 2021, "Azerbaijan 2030: National Priorities for Socio-Economic Development" were identified; by the Order dated July 22, 2022, the "2022–2026 Socio-Economic Development Strategy of the Republic of Azerbaijan" was approved; as well as a number of state programs covering various sectors of the economy. The strategic goal set in these documents is to achieve a

competitive economy, high-quality human capital, and innovative development in Azerbaijan in the medium and long term. Clause 3.3 of the aforementioned 2022–2026 strategy defines the "strategic framework for a competitive human capital and a space of modern innovations." In order to achieve the targets set in these documents and other state programs, and to increase the role of knowledge in economic progress, continuous reforms are being implemented. In particular, measures are being taken to improve legislation, establish regulatory bodies, improve infrastructure and the business environment, stimulate innovative ideas, as well as provide state support to start-ups. However, the measures implemented have not been able to create a synergy effect between macro factors and sectors. This can be seen from our position in international comparative rankings and statistical figures. This can also be observed from our position in international comparative rankings and statistical figures. For instance, in the UN[1] Global Knowledge Index[2] (GKI), Azerbaijan ranked 64th out of 138 countries in 2020, but fell to 94th out of 133 countries in 2023. In the WIPO[3] Global Innovation Index[4] (GII), the country ranked 84th out of 132 countries in 2019, and 89th in 2023. In the WEF[5] Global Competitiveness Index[6] (GCI), Azerbaijan held the 40th position out of 140 countries in 2015, but dropped to 58th in 2019. As can be seen, there has been a decline in Azerbaijan's positions in the mentioned global ranking reports. According to World Bank statistics, in 2023, the share of knowledge-intensive sectors in GDP ranged between 25% and 50% in leading countries, while it was approximately 10% in Azerbaijan, 11.3% in Belarus, 16% in Russia, 13% in Kazakhstan, and around

[1] United Nations
[2] Global Knowledge Index 2020; 2023
[3] World Intellectual Property Organization
[4] Global Innovation Index 2019, 2023
[5] World Economic Forum
[6] Global Competitiveness Report 2015, 2019

13.6% in Georgia. These comparisons indicate that Azerbaijan lags behind both regional and global averages in terms of key indicators of the knowledge economy.

The main factors holding Azerbaijan back include: low funding for science, education, and information; an underdeveloped creative environment; weak innovation and investment activity; undervaluation of human capital; lack of incentive mechanisms; low innovation activity; an uncompetitive business environment; monopolistic tendencies; low institutional efficiency; and poor market competitiveness.

To enhance the development of knowledge and skills in Azerbaijan, effective regulation is required across ESIS and relevant macro factors. Failure to ensure such regulation weakens economic activity and negatively affects the production of competitive goods and services.

To date, numerous studies have been conducted on the formation, development, and regulation of the knowledge economy. However, these studies have not comprehensively examined the interaction of the macro factors affecting knowledge development with the formation of the knowledge economy, the interaction between ESIS and macro factors, or the sectoral characteristics of liberal vs dirigiste approaches to regulating the knowledge economy (and ESIS) in a holistic manner. In this regard, conducting fundamental and applied research on state regulation of the formation of the knowledge economy is extremely relevant.

In general, the knowledge in use today has passed through a long historical development. Undoubtedly, from ancient times to the present, scientific-philosophical works, research, discoveries, and inventions have played a huge role in changing worldviews, cognition, economic, political, and social behaviors, and improving well-being. Thinkers such as Confucius, Thales, Anaximander, Anaximenes, Xenophanes, Pythagoras, Heraclitus, Plato, and Aristotle from the pre-Christian era, as well as Plutarch, M.T.Cicero, Al-Farabi, A.Yasawi, Avicenna (Ibn Sina), Bahmanyar, N.Tusi, Baruch Spinoza, F.Bacon, T.Kuhn, G.W.F.Hegel, I.Kant, R.Descartes, J.Locke, P.Tannery,

K.Popper and many others from the Christian era, have played a significant role in shaping worldviews and contributing to the development of knowledge.

In the change of economic worldview, scholars such as S.Simon, S.W.Petty, A.Smith, A.Marshall, D.Ricardo, T.Malthus, K.Marx, J.S.Mill, L.Walras, J.B.Clark, F.List, H.D.Macleod, and others made great contributions. They conducted valuable research on economic worldview, the human factor and human economic function, the impact of profession and skills on economic development, the free market economy, economic regulation, etc.

On the problem of state regulation of the economy, many other scholars have carried out fundamental research: for example, T.Mun, J.M.Keynes, J.K.Galbraith, P.Samuelson, M.Friedman, R.Solow, F.Modigliani, J.Tobin, R. Barro, N.G.Mankiw, R.Lucas, R.E.Hall, P.Romer, R.Robins, J.Brughel, C. Benoit, D.P. Barbara, H.Beales, etc. In Azerbaijan, research on state regulation of the economy dates back to the period after gaining economic and political independence. In those years, economists such as M.H.Maybullayev, A.A.Nadirov, Z.A.Samadzade, A.A.Aliyev, Sh.M.Muradov, A.X.Nuriyev, A.F.Musayev, I.H.Aliyev, T.A.Guliyev, T.H. Huseynov, Sh.S.Gafarov, N.M.Muzaffarli, F.F.Mustafayev, H.B. Allahverdiyev, M.A. Ahmadov, A.Sh. Shakaraliyev, P.Q.Rzayev, Y.A.Kalbiyev, G.Z.Yuzbashiyeva, T.A.Pasha and others have carried out scientifically practical research on the transition to a market economy and state regulation of the economy.

There is a strong synergy between the formation and development of the knowledge economy and institutions, the management system, the business and investment environment, trust, etc. In general, regarding the role of institutions in economic development, researchers such as A.Joshi, A.Maddison, C.Eesley, C.Visser, D.C.North, D.Schiller, E.Brousseau, İ.Z.Seyfullayev, S.Wang, T.Veblen, V.H.Hamilton, V.J.Henisz, X.Su, etc., have conducted studies. On the impact of the business environment on economic growth, studies have been done by A.A.Khrisheva, A.M.Weimer, A.Glodovska, A.Y.Obukhov, C.Arkolakis, D.Lvov, D.Grinevage, E.Helleiner, İ.V. Sonchev, J.A.Frieden,

J.Cai, J.Dvorsky, J.K.Muhanika, J.Meyer-Stamer, L.C.Xu, M.H.Zeynalov, N. Bosma, N. Hozouri, N. Wang, R. Falvey, R.Rogovsky, S.Edwards, S.Rogerson, S.White, T.A.Aliyev, V.Keller, Z.J.Acs, Z.Lizhong, Z.Zhaoqiang, etc. On trust and the economy, F.Fukuyama, F.L.Jaffee, I.Bohnet, P.François, P.Y.Zak, R.C.Mayer, S.S.Lluis, T.Kuo, T.Veblen, Y.Algan and others have conducted research.

Regarding knowledge-based society and the knowledge economy, scholars such as B.F.Jones, B.Godin, C.Dahlman, J.Stiglitz, D.Beckstead, D.Bell, A.Toffler, F.Hayek, F.Machlup, G.Benko, I.Brinkley, I.Lopez, K.Popper, K.Smith, L.Edvinsson, M.Tokan, P.Cooke, P.Maskell, R.Solow, T.Stewart, T.Stoner, V.P.Walter and others have carried out research.

In Azerbaijan, the number of studies on the knowledge economy is not very high. These studies mainly examined general features of the knowledge economy, and in some cases at the sectoral level. In these studies, human capital — the main carrier of knowledge economy formation and development — and the macro factors affecting it have not been studied comprehensively. World-renowned scholars such as T.Schultz, G.Becker, E.Denison, R.Solow, J.Kendrick, S.Kuznets, İ.Fisher, R.Lucas, J.Mincer, L.V.Hansen, A.Maslow, A.Sen, M. Ul.Haq, R.Layard, and others have achieved fundamental results regarding human capital. In Azerbaijan, significant research on the development of human potential and capital has been conducted by Sh.M.Muradov, Q.C.Imanov, X.M.Yahudov, T.A.Guliyev, K.A.Shahbazov, R.Sh.Muradov, T.H.Huseynov, G.A.Azizova, C.B.Guliyev, R.S.Abdullayeva, F.Q.Musayeva, R.C.Efendiyev, P.S.Hasanovand others.

One of the driving factors in the formation and development of the knowledge economy is innovation activity. The impact of innovation on economic development has been researched by Y.Schumpeter, P.Drucker, D.Aaker, J.S.Metcalfe, R.Nelson, B.Santo, E.Mansfield, A.B.Jaffe, D.Sakhs, N.Rosenberg, H.Ulku, R.P.Maradana, S.Thangavelu, X.Long, J.Dempere, and others. In Azerbaijan, A.F.Musayev, T.N. Aliyev, Q.S. Suleymanov, Z.M. Najafov, F.H. Gasimov, A.D.Huseynova, S.H.Abbasova, R.K.Iskandarov, R.M.Jabiyev, P.A.Hasanova, İ.A.Aslanzade, E.E.Mammadzade, A.H.Taghiyev and

others have researched innovative development, innovation activity, and the role of innovations in economic development.

ESIS occupies a central place in the formation and development of the knowledge economy. To date, numerous studies have been devoted to the role of education, science, and ICT in socio-economic development worldwide and in Azerbaijan. Foreign scholars such as J.S. Coleman, İ.Öztürk, R.J.Barro, A.V.Cooray, D.N.Weil, D.Checchi, A.B.Krueger, E.A. Hanushek, R.G. Ehrenberg, C. Dewey, B. Levinger, O.Liu, R.Atkinson, T.Astebro, H.Bulut, C.Wieman, and others, and Azerbaijani scholars such as Z.F.Mammadov, U.Q.Aliyev, C.B.Guliyev, H.A.Hamidov and others have investigated this issue.

On the economics of science, foreign scholars including K.Arrow, B.Hall, A.Toffler, N.Kondratiev, B.Z.Milner, G.M.Dobrov, N.Rosenberg, R.Nelson, K.Nelson, P.A.Kulvet, L.E.Mindeli, V.A.Ilyin, G.Itskovich, D.Stein, D.Audretsch, P. Aghion, R. Belderbos, P.A.David, C.Franzoni, D.Lentile, P.Heinze, N.H.Steneck, S.L.Titus, etc., and Azerbaijani scholars Sh.M.Muradov, A.F.Musayev, S.S.Khalilov, R.K.Iskandarov, R.A.Agayev, G.A.Ganjiyev, A.D.Huseynova, S.B.Mammadov, and others have carried out research.

Regarding the role of information provision in the formation and development of the knowledge economy, foreign scholars S.J. Grossman, Y.Masuda, M.Castells, H.S.Dordick, J.E.Stiglitz, E. Coiera, C.Shapiro, J.C.Aker, C.Degryse, V.L. Inozemtsev, R. Nizhegorodsev, and Azerbaijani scholars A.M. Abbasov, R.M. Aliguliyev, T.Q. Aliyev, G.I. Ismayilov, M.H. Mammadova, L.A. Allahverdiyeva, A.Q. Aliyev, and others have conducted studies.

Of course, every scientific research is significant and possesses distinct and specific characteristics that differentiate it from those that came before. The main distinction of this research from similar studies conducted in Azerbaijan and abroad lies in its comprehensive evaluation of the synergy effect between the regulation of KE development and the interplay of economic and non-economic factors. Moreover, it introduces a new methodology to measure the degree of dirigisme-liberalism in the development of knowledge and its core pillars-education, science, innovation, and information activities.

In the modern era, where knowledge, digitalization, artificial intelligence, and robotics are rapidly evolving, the research problem addressed in this study is of particular relevance and urgency.

The object of the research is the macro factors influencing the development of the knowledge economy (such as institutions, business environment, innovation and investment activity, human capital, trust, etc.) and the education, science, and information sectors (ESIS); **while the subject of the research** is the study of the theoretical, methodological, and practical aspects of the economic relations, events, and interactions between these macro factors and ESIS in the context of the formation and development of the knowledge economy..

Purpose and tasks of the research: The primary objective of the research is to identify the macro-level economic and non-economic factors that directly and indirectly affect the development of the knowledge economy, to assess their interrelationships with ESIS, innovation-investment activities, and the use of human capital, and to develop proposals for improving state regulation in this field. To achieve this goal, seven key research tasks have been defined.

1. Studying the conceptual foundations of the role of knowledge in the stages of societal development and the transformation of worldview, and presenting the author's original perspective.

To accomplish this task, the research will explore the stages of societal development, worldview, cognition, knowledge and scientific knowledge, and the essence of KE from both socio-economic and philosophical-economic perspectives. It will also analyze the impact of knowledge development on changes in worldview, economic growth, and the overall improvement of public welfare.

2. **Investigation of the macro factors contributing to the formation and development of KE, and their interrelation with innovation, investment, and human capital.**

This task involves analyzing both economic and non-economic factors that directly or indirectly influence the development of knowledge; reviewing existing approaches to the regulation of KE, human capital development, and innovation-investment activities;

and exploring synergy-based interconnections among these macro factors.

3. **Investigation of the theoretical aspects of the interrelationship between the effectiveness of ESIS and macro factors, their role in knowledge development, and the regulation of these sectors.**

To fulfill this task, the study will examine the regulatory frameworks of ESIS, their contribution to knowledge development, the interrelations among these sectors, and the theoretical-methodological dimensions of their interactions with economic and non-economic macro factors.

4. **Evaluation of the synergy effect of the relationship between macro factors and the formation and development of KE, conducting international comparisons, and identifying the challenges of KE development in Azerbaijan.**

This task includes assessing the interconnections between macro factors and the development of skills, innovation, and human capital based on international reports and statistical data. It also involves analyzing the de jure and de facto business environment, the innovation-investment climate, and the development of human capital in Azerbaijan; conducting cross-country comparative analyses; and evaluating the synergy among KE-related macro factors.

5. **Analysis of the current state of ESIS, conducting international comparisons, assessing the synergy between macro factors and ESIS, and identifying the main barriers to sectoral development.**

This task entails evaluating the current condition and development level of ESIS in Azerbaijan using international benchmarking; conducting assessments in terms of quantity, quality, and effectiveness; analyzing intra-sectoral, inter-sectoral, and extra-sectoral relations; and identifying key constraints that hinder the advancement of these sectors.

6. Measuring the level of dirigisme–liberalism in KE, conducting international comparisons, and evaluating the degree of state regulation of ESIS and innovation activities.

To accomplish this task, a new methodology will be employed to assess the level of dirigisme–liberalism in education, science, information, and innovation activities. The Knowledge Economy Dirigisme–Liberalism Index (KEDLI), along with the regulatory scope within ESIS, will be calculated. Comparative international analyses will be carried out, and the strengths and limitations of state intervention in these sectors will be evaluated.

7. Developing scientifically grounded proposals and recommendations to accelerate the formation and development of KE in Azerbaijan and to enhance the efficiency of regulatory mechanisms across macro factors and sectors.

This task will be carried out based on the theoretical insights and analytical evaluations presented in the previous sections. The recommendations will aim to strengthen the impact of macro-level factors on knowledge development in a more integrated, effective, and sustainable manner.

Research methods: The research employs methods of analysis, synthesis, idealization, induction, deduction, comparative and systems analysis, statistical measurement, logical analysis, synergetic approach, observation, correlation analysis, and generalization.

Main propositions advanced for defense:

1. There is a direct relationship between the stages of societal development and the rate of knowledge development. As the rate of knowledge development increases, the time required to transition between stages of societal development decreases.
2. Knowledge influences the enhancement of productivity and competitiveness, contributing to the transformation of worldview (national, economic, political, religious, etc.), while the transformation of worldview, in turn, stimulates the development of knowledge.
3. A number of economic and non-economic macro factors have a significant synergy effect on the formation and development of KE.
4. The development of KE depends on the improvement of the quality of HC, the transformation of acquired knowledge into economic value, and the effectiveness of the interrelation among macro factors.

5. The development of KE depends on the effectiveness of regulating the interaction between innovation-investment activity and macro factors.
6. In order to increase the economic effectiveness of R&D and its role in KE, it is essential to focus on both internal and external factors.
7. Macroeconomic stability, institutional efficiency, protection of property rights, the existence of infrastructure, the de facto favorability of the business environment, and trust in the future of business are essential conditions for accelerating the formation and development of KE.
8. The formation, use, and development of HC depend on the overall socio-political environment, the education and healthcare systems, the regulation of macro factors (institutions, business environment, labor market, etc.), and the social protection system.
9. Although Azerbaijan possesses certain potential (HC, investment, infrastructure, etc.) for innovative development, the level of utilization of this potential remains low.
10. The formation and development of KE depend not only on the internal conditions of the education system but also on the efficient use of education expenditures and the influence of external factors.
11. In Azerbaijan, the relationship between scientific research activities and the business sector is very weak and significantly depends on the de facto favorability of the business environment and trust in business.
12. The development of KE largely depends on the level of collection, processing, storage, language, speed, and accessibility of information (scientific, technical, technological).
13. Accelerating the formation of KE requires the implementation of a liberal-oriented regulatory policy, which stimulates the development of knowledge.
14. It is essential that the pre-university education system be based on dirigiste regulation, while university education be based on liberal regulation.
15. A high degree of liberalism in scientific activity and the flexibility of incentive mechanisms are essential for the development of knowledge.

16. For innovation activity to be effective, the elements of the NIS must primarily be regulated through liberal and incentive-based mechanisms.
17. The regulation of information provision on liberal and incentive-based grounds is a crucial condition for the accessibility of information products.
18. When economic and non-economic macro factors, the quality of HC, R&D, and innovation-investment activity interact effectively, the efficiency coefficient of the KE "engine" increases. In this context, it is necessary for the "engine-driving" elements to be based on dirigiste regulation, and the "accelerating" elements to be based on liberal regulation.

Scientific novelty of the research:

1. Unlike existing approaches, the development of society has been divided into 7 stages: agro-agrarian, agrarian, agro-industrial, industrial, post-industrial, knowledge-based, and nano society.
2. It has been substantiated that knowledge and skills are specific production factors of the new economy, and that KE is a universal system ensuring the competitive and sustainable development of society.
3. The economic and non-economic macro factors influencing the development of KE have been identified, and it has been substantiated that the interrelationships among these factors possess a synergy effect.
4. The theoretical aspects of the synergy effect between macro factors and the formation, quantity and quality, and efficient use of HC in KE have been substantiated.
5. The synergy effect of the relationship between the regulation of economic and non-economic macro factors and the development of innovation-investment activity in the construction of KE has been theoretically substantiated.
6. It has been theoretically substantiated that external macro factors have a stronger impact on the development of knowledge compared to internal factors in the education, science, and information sectors.
7. There is a strong correlation and synergy effect between the formation and development of KE and economic and non-economic macro factors, and this result is of a general nature.

8. For the first time, the Human Capital Development Index (HCDI) has been calculated for 92 countries based on a different methodology (formation, capitalization, use, and efficiency), and a ranking has been compiled.
9. The total amount of expenditures for the development of HC in Azerbaijan has been calculated, and the synergy effect between macro factors and the formation, use, and utility of HC has been evaluated.
10. It has been substantiated that there is a strong relationship between innovation-investment activity and KE, the de facto business environment, trust, institutional efficiency, protection of property rights, as well as stimulating and incentivizing mechanisms.
11. It has been substantiated that there is a strong synergy effect between the quality and economic efficiency of education and macro factors (institutions, business environment, trust, labor market, etc.).
12. It has been substantiated that there is a strong cause-effect relationship between the development of science and the de facto favorability of the business environment, trust, and other related factors.
13. The synergy effect between the development of KE and the provision of society with necessary (scientific, technical, technological, etc.) information, as well as macro factors, has been evaluated.
14. For the first time, the Knowledge Economy Liberalism–Dirigisme Index (KELDİ) has been calculated, and the necessity of a liberal approach to KE has been substantiated.
15. For the first time, the Education System Liberalism–Dirigisme Index (ESLDİ) has been calculated, and the importance of dirigisme, i.e., strong state intervention in the education system, has been substantiated.
16. For the first time, the Scientific Activity Liberalism–Dirigisme Index (SALDİ) has been calculated, and the importance of a liberal approach for the development of scientific activity has been substantiated.
17. For the first time, the Innovation Activity Liberalism–Dirigisme Index (IALDİ) has been calculated, and the importance of a liberal "flexible" approach to regulating innovation activity has been substantiated.

18. The Information Provision Liberalism–Dirigisme Index (IPLDİ) has been calculated, and the importance of a high level of liberalism for the accessibility of scientific, technical, and technological information has been substantiated.
19. For the first time, a model of a balanced combination of dirigiste and liberal regulation for increasing the efficiency coefficient of the KE "engine" has been proposed, substantiating the relationship between "demand pressure" and "knowledge pressure," as well as the importance of a dirigiste approach during the formation process and a liberal approach during the development process.

Theoretical and practical significance of the research: Theoretical findings of the research can be applied in the development of state programs and strategies, as well as in the teaching of disciplines such as the economics of science, KE, economics of education, information economy, and innovation management. The results can also be utilized in addressing KE-related challenges, designing relevant programs and concepts, optimizing state intervention, and supporting policy decisions aimed at enhancing the role of knowledge in economic development.

Approbation and implementation: The results of the research have been utilized in the preparation of the draft Law "On Innovation Activity" (reference no. 17/06-5/92-5/854 dated August 3, 2010); in the preparation of the "National Strategy for the Development of Science in the Republic of Azerbaijan for 2009–2015" and the related State Program for its implementation (reference no. 01-8/408 dated April 18, 2012); in the preparation of the "Azerbaijan 2020: Vision of the Future" Development Concept (reference no. 01-8/409 dated April 18, 2013); and in the expert review and preparation of the final document of the "Strategic Roadmaps for the National Economy and Main Sectors" (reference no. 138/003/17 dated July 21, 2017). In addition, the author has presented the research findings at more than 20 international scientific-practical conferences.

Publications: Over 93 scientific works (totaling more than 500,000 characters) related to the topic of the dissertation have been published. These include 11 books (1 individual monograph, 1 Textbook, 3 co-authored and Collective monograph) and 82 articles and theses. 22 of

the articles and theses were published in foreign journals, including 2 in journals indexed in the SCOPUS scientific database.

Place of research: The dissertation work was carried out at the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan.

Volume and structure of the dissertation: The research consists of an introduction, 8 chapters, and a conclusion with recommendations. Excluding the reference list, the dissertation comprises approximately 440189 characters in length, typed in electronic format. It includes 15 figures, 65 charts, 12 main tables, and 11 additional tables. The list of references contains a total of 592 sources (578 initially and 14 subsequently added), including literature in Azerbaijani, Turkish, Russian, and English, as well as various internet resources.

Introduction

CHAPTER I. THE THEORETICAL ASPECTS OF THE MUTUAL RELATIONSHIP BETWEEN CHANGE IN WORLDVIEW AND DEVELOPMENT of KNOWLEDGE

19.1. Concepts regarding the role of knowledge in the stages of soci- etal development

19.2. Philosophical-economic view of changes in worldview and the development of knowledge

19.3. The theoretical and methodological foundations of the formation of the knowledge economy

CHAPTER II. THE THEORETICAL-METHODOLOGICAL FOUNDATIONS OF REGULATING MACRO FACTORS INFLUENCING KNOWLEDGE ECONOMY BUILDING

2.1. Theoretical perspectives on macro factors affecting knowledge development

2.2. Theoretical aspects of regulating the innovation-investment environment

2.3. Regulation of macro factors affecting the formation of human capital

CHAPTER III. THE THEORETICAL FOUNDATIONS OF REGULATING THE ACTIVITIES OF SECTORS DIRECTLY INVOLVED IN KNOWLEDGE DEVELOPMENT

3.1. Socio-economic foundations for regulating the education system

3.2. Organizational-economic aspects of regulating scientific activity

3.3. Conceptual foundations of regulating information provision

CHAPTER IV. ANALYSIS AND EVALUATION OF MACRO FACTORS AFFECTING THE FORMATION OF THE KNOWLEDGE ECONOMY IN AZERBAIJAN

4.1. Evaluation of the relationship between macroeconomic stability, the business environment, and mutual trust with knowledge development

4.2. Analysis of factors affecting the formation and use of human capital in Azerbaijan

4.3. Assessment of the relationship between innovation activity and the investment environment

CHAPTER V. ANALYSIS OF THE CURRENT STATE OF THE EDUCATION, SCIENCE, AND INFORMATION SECTORS IN AZERBAIJAN AND EVALUATION OF THEIR IMPACT ON KNOWLEDGE DEVELOPMENT

5.1. Analysis of the current state of educational services and evaluation of their interaction with macro factors

5.2. Evaluation of the current state of scientific potential

5.3. Analysis and evaluation of the current state of the information provision system

CHAPTER VI. MEASURING THE LEVEL OF LIBERALITY AND DIRIGISME IN KNOWLEDGE ECONOMY BUILDING: METHODOLOGY AND INTERNATIONAL COMPARATIVE EVALUATION

CHAPTER VII. DIRECTIONS FOR IMPROVING THE IMPACT OF MACRO FACTORS ON THE FORMATION AND DEVELOPMENT OF THE KNOWLEDGE ECONOMY IN AZERBAIJAN

7.1. Mechanism for regulating the mutual interaction of factors driving the knowledge economy

7.2. Improving the impact of macro-factor regulation on the knowledge economy

7.3. Ways to improve the formation and use of human capital

7.4. Ways to increase innovation activity in the economy

CHAPTER VIII. CHAPTER VIII. SECTORAL REGULATION DIRECTIONS OF THE KNOWLEDGE ECONOMY IN AZERBAIJAN

8.1. Directions for improving the regulation of educational services

8.2. Ways to develop science and commercialize research results

8.3. Directions for improving information provision in society

FINAL RESULTS OF THE DISSERTATION AND SOLUTIONS TO IDENTIFIED PROBLEMS

Theoretical and practical results
Solutions to the problems (proposals and recommendations)
List of references used
Appendices
Abbreviations
New concepts

GENERAL CHARACTERISTICS OF THE DISSERTATION, MAIN PROVISIONS SUBMITTED FOR DEFENSE, AND SCIENTIFIC INNOVATIONS

In the introduction of the dissertation, detailed information is provided regarding the relevance and the degree of development of the topic, the objectives and tasks of the research, the object and subject of the research, the research methods, the main provisions submitted for defense, the scientific novelty, theoretical and practical significance, the approval and application of research results, as well as the structure and volume of the dissertation.

The first chapter, titled **"Theoretical Aspects of the Interaction between the Change of Worldview and the Development of Knowledge,"** explores and systematizes the stages of social development, concepts regarding the driving influence of knowledge and worldview on these stages, and views related to the knowledge economy. The philosophical and economic aspects of the interaction between changes in worldview and knowledge development are studied.

Clarifications are given to the concepts of "post-industrial society," "knowledge society," "information society," and "knowledge economy." The theoretical aspects of the influence of mentality, economic, political, and religious worldviews on the development of society and knowledge are investigated, and several important results are obtained.

Proposition: *There is a direct relationship between the stages of societal development and the rate of knowledge advancement. As the pace of knowledge development increases, the time required to transition between stages of societal development decreases.*

Scientific Novelty: *Unlike existing approaches, societal development has been classified into seven stages: agro-agrarian, agrarian, agro-industrial, industrial, post-industrial, knowledge-based, and nano society.*

Justification: The shortening of "time" between the stages of societal development is directly related to the advancement of knowledge and the transformation of worldview. While the transition from agriculture to industry took thousands of years, the shift from industry to post-industry occurred within about 300 years. The production of hunting tools, shelters, the discovery of fire and writing, accelerated this

process. As the generation, transmission, and dissemination of new knowledge (especially practical knowledge) accelerated, scientific knowledge developed, production tools improved, and the possibilities for knowledge dissemination expanded, reducing the duration between development stages of society.

Based on research in this direction, the development stages of society are divided into 7 stages:

1. Ago-agrarian society ("ago" is a Greek word meaning "before"): This stage covers the period up to the 100th century BCE. During this phase, people were engaged in hunting and gathering.

2. Agrarian Society: The agrarian society lasted from the 100th century BCE to the 4th century CE (approximately 10,400 years). During this period, a sedentary lifestyle was formed, agriculture, animal husbandry, and weaving developed, settlements were built, and new types of occupations emerged.

3. Ago-Industrial Society: Continued from the 5th to the 17th century. In this pre-industrial period, production tools and mechanical devices for processing agricultural products developed.

4. Industrial Society: Spanned from the second half of the 17th century until the 1970s. This period was marked by inventions and the industrial revolution.

5. Post-Industrial Society: Dominated by the service sector and lasted from the 1970s to the early 21st century.

6. Knowledge Society or Information Society: Characterized by the dominance of knowledge and information rather than any specific sector. In this stage, knowledge is the main driver of economic development.

7. Nano or Techno Society: Characterizes the present era, marked by artificial intelligence, digitalization, and individualization, where the economy and technological achievements are shaped by individuals.

Proposition: *Knowledge contributes to increased productivity and competitiveness, influencing the transformation of worldview (national, economic, political, religious, etc.), while the transformation of worldview, in turn, stimulates the development of knowledge.*

Scientific Novelty: *It has been substantiated that knowledge and skills are specific production factors of the new economy, and that the KE is a universal system ensuring the competitive and sustainable development of society.*

Justification: Although the concept of "knowledge" seems simple at first glance, it is not, because new knowledge develops through long stages, complex processes, and tests, turning into a useful "product" that transforms worldviews. The development of knowledge influences both general and economic worldviews. It is these changes that drive societies from one development stage to another. In many studies, knowledge is classified into three parts: common (life-related), practical, and scientific knowledge.

In societies, political, economic, and sometimes religious worldviews change depending on the level of knowledge development. A low level of knowledge undoubtedly hinders the development of worldviews. In this regard, acquired knowledge is the main driving force behind changes in thinking, worldview, and socio-economic development. The change of worldview is also influenced by economic events and processes, lifestyle, religious beliefs, political environment, etc.

Summarizing all these thoughts, it can be concluded that there is a close interaction between the development of knowledge and the change (evolution) of worldview. The development of knowledge is a continuous and stage-by-stage process. The level of socio-economic development of society connects all stages of this process into a system.

In general, all approaches related to worldview are based on the relationship of humans to nature and society, beliefs, cognitive activity, understanding the world and oneself. In this sense, worldview can be characterized as a system of views, ideas, and norms related to society's (individuals') perception of reality and the direction and improvement of their activities. In all cases, the change of worldview becomes possible through the development of knowledge, including economic and political worldviews.

In this work, KE is regarded as an economy that achieves high socio-economic benefits through the development of knowledge, i.e., an

economy where knowledge and innovation dominate economic development. KE is an open system in which the sectors (and fields) that directly and indirectly contribute to the development of knowledge operate in close interconnection. This process highlights the application of flexible, incentive-based regulatory mechanisms to transform a new idea into an innovative product (value).

In the second chapter of the dissertation, titled **"Theoretical and Methodological Foundations of Regulating Macro Factors Influencing the Formation of the Knowledge Economy"**, the main macro factors affecting the formation and development of the KE are analyzed, the interaction of these macro factors with the KE system is studied, and the author proposes new approaches. In this section, the theoretical evaluation of the impact of key macro factors - such as healthy competition, macroeconomic stability, business environment, mutual trust, innovation-investment climate, human capital, institutions, property rights - on KE formation is carried out, resulting in several significant conclusions.

Proposition: *A number of economic and non-economic macro factors have a significant synergy effect on the formation and development of KE.*

Scientific Novelty**:** *The economic and non-economic macro factors influencing the development of KE have been identified, and it has been substantiated that the interrelationships among these factors possess a synergy effect.*

Justification: Macro factors regulating KE refer to economic and non-economic factors that play an essential role in transforming knowledge into economic value. These include macroeconomic stability, business, innovation and investment environment, institutions, property rights, trust, state integrity, rule of law, quality, and efficient use of human capital, among others. These factors are closely interconnected and influence each other's functioning. At the same time, each factor has its own influence power, structural elements, and regulatory mechanisms. The main issue here is to achieve the effectiveness of regulation.

It is clear that in all countries, the state (government) regulates economic events and processes, and this forms the basis of the existence

of these states. However, the effectiveness of regulation may vary depending on the level of economic development, the extent of social obligations assumed by the state, the socio-political environment, mentality, and global and national events and processes. Thus, state intervention in the economy can sometimes accelerate development, while in other cases it may cause stagnation or recession.

In all cases, the efficiency of the interaction of KE's regulatory macro factors with knowledge development ensures a positive synergy effect in society and the economy. Taking this into account, developed countries widely apply various stimulating and incentive regulatory methods and tools.

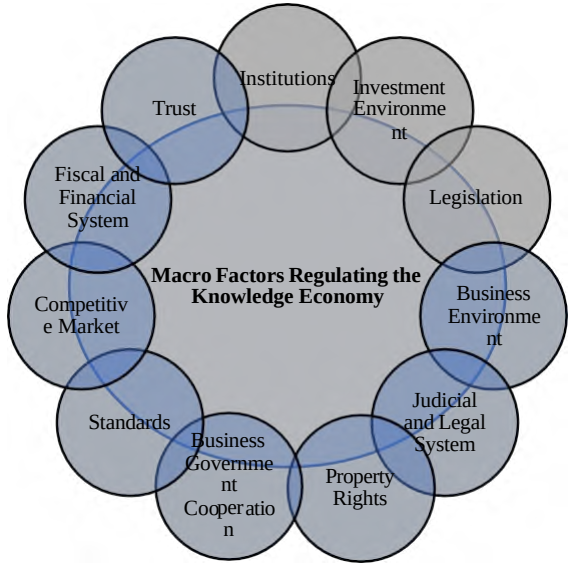


Figure 1. Factors Influencing the Formation of the KE

Note: The figure was developed by the author.

The effectiveness of regulating the interrelations among macro factors, as well as between sectors and sub-sectors of the economy, can be evaluated using macroeconomic and quality-of-life indicators. In this context, the development of the knowledge economy should be regarded as an essential component of state economic regulation. Naturally, there is an "optimal framework threshold" for the level of state

intervention in the economy – whether liberal or dirigiste. Any intervention exceeding or falling short of this threshold can lead to economic inefficiencies. Based on the analysis of economic events and processes, and depending on the current state of the business sector, the implementation of "flexible regulation" measures by governments is considered more appropriate. In our view, the efficiency of regulation across macro factors and sectors is a necessary condition for the formation of the knowledge economy.

Proposition: *The development of KE depends on the improvement of HC quality, the favorability of the environment for transforming acquired knowledge into economic value, and the effectiveness of interrelations among macro factors.*

Scientific Novelty: *Theoretical aspects of the synergy effect of the interrelationship between macro factors and the formation, quantity, quality, and efficient use of HC in KE have been substantiated.*

Justification: In the modern world, special importance is attached to the formation and quality of HC, as well as to the transformation of acquired knowledge into economic benefit. Experience shows that for HC development, there is a strong synergy effect between quality education and healthcare services, a favorable environment for the realization of acquired knowledge and skills, trust, institutions, and other economic and non-economic macro factors. Historically, in closed and authoritarian systems lacking a favorable business and competitive environment, the use of HC has faced problems, and rapid "brain drain" has occurred.

From this perspective, HC development, quality, and usage depend on a favorable economic environment, free thinking, a liberal economy, healthy competition, labor market institutions, investments, innovations, trust, and other macro factors.

Unlike other types of capital, HC is intangible and only turns into value when used purposefully. This capital is formed within each individual (as knowledge, skills, and professions) and, unlike other tangible capitals (financial, property, etc.), cannot be directly transferred to others. It only contributes to economic development under a favorable environment.

HC is the "central brain" of economic development. It forms the foundation of economic development and social welfare. HC and the economic environment are complementary and reinforcing factors. States must pay balanced and equal attention to both areas in their long-term development strategies.

Proposition: *The development of KE depends on the effectiveness of regulating the interaction between innovation-investment activity and macro factors.*

Scientific Novelty: *The synergy effect of the interrelationship between the regulation of economic and non-economic macro factors and the development of innovation-investment activity in the construction of KE has been theoretically substantiated.*

Justification: Innovation-investment activity includes all activities directly or indirectly involved in the creation of new products and services. It covers the activities of all subjects participating in all stages, from the emergence of a new idea to its transformation into a finished product. In other words, innovation-investment activity involves all the sequential activities necessary for transforming an idea into a product, its development, use, and dissemination.

The development of innovation-investment activity and the formation of the synergy effect depend on the harmonious interaction of factors such as institutions, trust, property rights, healthy competition, human capital, and a favorable business environment. These connections play a decisive role in the realization of innovative ideas and their transformation into economic value.

Especially, as investments directed toward new ideas carry higher risks, many countries apply special regulatory mechanisms to minimize these risks and stimulate the investment environment. Tax credits, subsidies, risk insurance, tax concessions, and venture capital play significant roles among these mechanisms. Venture capital, also known as venture investment, is used for financing high-risk but potentially high-return projects.

In such an environment, the state's incentive and stimulating mechanisms are of great importance for the formation of a knowledge and innovation-based economy. Creating a favorable business environment, increasing trust, and effectively managing risks enhance the

country's innovation potential and accelerate its economic development. This approach also contributes to the development and effective use of human capital, ensuring the sustainable growth of the economy.

The third chapter of the research, entitled "**Theoretical Foundations of Regulating the Activities of Sectors Directly Involved in Knowledge Development**," is dedicated to the theoretical aspects of regulating the three main sectors that directly contribute to knowledge development: education, science, and information systems (hereinafter referred to as the ESI sectors).

In this chapter, the distinctive characteristics of education, science, and information, their roles in the development of KE, the internal and external factors affecting the functioning and regulation of these sectors, and the theoretical aspects of their interaction with each other and with macro factors are analyzed, resulting in significant conclusions.

Proposition: *Ensuring the economic efficiency of ESİS and enhancing its role in KE requires close attention to both internal and external system factors.*

Scientific Novelty: *It has been theoretically substantiated that external macro factors have a stronger impact on knowledge development compared to the internal factors of the education, science, and information sectors.*

Justification: The efficiency of ESI contributes to knowledge production, dissemination, assimilation, and application, thereby promoting societal development and increasing the role of knowledge in the economy. The strength and resilience of ESI, which are the main pillars of KE formation, depend not only on internal system factors but also on external macro factors.

Unlike traditional approaches, this research investigates the interaction between external system factors (e.g., economic system, labor market, technological development) and internal system factors (management, human capital). The study focuses not only on the internal parameters of the system but also on its relationship with the external environment.

ESI plays a special role in knowledge development, human capital formation, and the transformation of acquired knowledge into products. It is assumed that the importance of ESI has increased even more

today. The state regulation of ESI is multi-faceted and includes economic, social, legal, political, and organizational aspects. Each pillar of ESI requires a specific regulation method.

The effectiveness of regulating the education system is measured by the quality of its main and final "product" — human capital, its role in economic growth, and its share in national wealth. Education services influence the formation and development of HC in two ways. First, the education system acts as the "producer" of human capital that creates new value in society. Second, the education system acts as the "consumer" of the human capital it produces since the personnel working within the education system are themselves the product of education.

If problems arise in the management and financing of education, its inclusiveness, or if the labor market and business lack a healthy competitive, institutional, and innovative environment, then the quality of education will most likely decline, weakening the role of HC in generating economic value.

Scientific activity is one of the sectors that plays a key role in KE formation. While education mainly serves as the transmitter of knowledge, science acts as the producer of knowledge. Today, technical, technological, organizational, social, and economic achievements, strategies, and programs that serve the progress and welfare of society are the results of scientific activity. Both the state and the business sector actively participate in knowledge production. Therefore, special regulatory measures are taken for the development of scientific activity. Like the education system, scientific activity is an open system influenced by both internal and external factors (economic and non-economic macro factors).

Since the main objective of scientific activity is the creation, assimilation, storage, and dissemination of new knowledge, its outcomes have a specific character.

The mechanism for regulating the financing of science is implemented in different forms in various countries. Moreover, the management of science and the commercialization of its results are carried out through different methods. The financing of science is provided by the

state, private sector, public organizations, and foreign investors, each with its own specific regulatory tools.

In the modern era, information (data, news, etc.) has become the primary raw material of all sectors, especially education, science, innovative development, competitiveness, economic growth, and, generally, the progress of society. Throughout all periods (even in ancient times), the information obtained has played a significant role in human, company, and state behavior and decision-making, and it continues to do so today. Especially in the context of a globalizing economy, information, as a raw material or product, has far greater material and moral significance than in previous periods.

In the fourth chapter of the research, entitled ***"Analysis and Evaluation of Macro Factors Influencing the Formation of the Knowledge Economy in Azerbaijan"***, the synergy effect of the interaction between macroeconomic stability, the de facto favorability of the business environment, institutions, property rights, mutual trust, knowledge development, human capital formation, and innovation-investment activity in Azerbaijan is evaluated. In this chapter, the economic and non-economic macro factors influencing the formation and development of KE, the level of human capital development, the value of HC in national wealth, expenditures on HC, and their interrelations are assessed, leading to several important conclusions.

Proposition: *Macroeconomic stability, institutional efficiency, protection of property rights, the availability of infrastructure, the de facto favorability of the business environment, and trust in the future of business are essential conditions for accelerating the formation and development of KE.*

Scientific Novelty: *There is a strong correlation and synergy effect between the formation and development of KE and economic and non-economic macro factors, and this finding is valid across all economies.*

Justification: For a long time (excluding the years affected by global crises), macroeconomic and political stability has prevailed in Azerbaijan. This is a significant factor for the country's economic development. Alongside ensuring macroeconomic stability, reforms have been implemented to improve both the de facto and de jure favorability

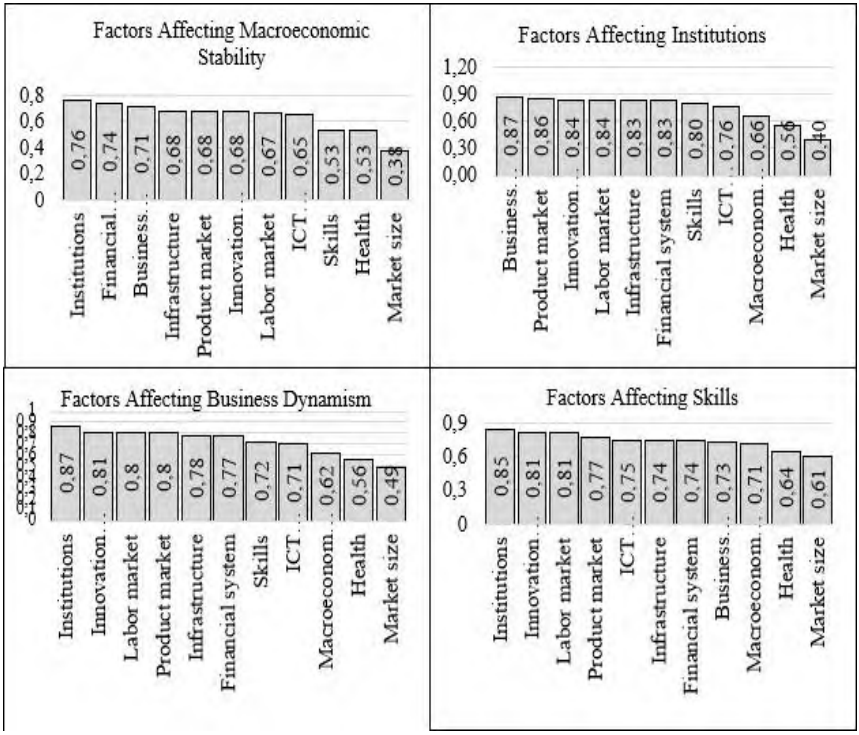
of the business environment and the functioning of institutions. In recent years, substantial progress has been achieved in improving the de jure favorability of the business environment. However, theoretical studies, reports by international organizations, cross-country comparisons, observations, and people's behavior indicate that, compared to de jure favorability, the de facto favorability of the business environment is more crucial for economic development. According to *The Economist Intelligence Unit*[7], Azerbaijan ranked 73rd among 81 countries in its real business environment report, indicating problems with the de facto business environment.

As shown in the previous theoretical chapters, economic and non-economic macro factors have a serious synergy effect on the development of KE alongside ESI sectors. To substantiate this, indicators from the *Global Competitiveness Index* (GCI), *Index of Economic Freedom* (IEF), and *Global Knowledge Index* (GKI) can be used. The analysis of dependencies among the 12 sub-indices of GCI shows that the business environment affects the development of knowledge and skills. (See Graph 1)

As can be observed, there is a strong correlation between institutions and infrastructure, ICT, macroeconomic stability, knowledge and skills, the goods market, the labor market, the financial system, business activity, and innovation potential. Institutions play a significant role in the development of knowledge and the enhancement of business activity.

Although macroeconomic stability is significant for economic development, institutions, infrastructure, and business activity are considered more critical than macroeconomic stability alone. There is a very strong correlation between the financial system and institutions, infrastructure, and business activity.

[7] Business Environment Rankings 2014: Which country is best to do business in? // From The Economist Intelligence Unit, – 2014, – 13 p. s.4



Graph 1: Correlation between macroeconomic stability, institutions, business activity, the financial system, and several factors — 141 countries, 2019

Source: Compiled by the author based on "The Global Competitiveness Index 4.0 - 2019" [8] using Excel.

The development of KE also requires freedoms, especially economic and creative freedoms, and a fair legal system. Protection of property rights, judicial effectiveness, financial and business freedom, state integrity, and measures that increase general economic activity are essential for the development of KE. (See Table 1)

[8] The Global Competitiveness Index 4.0 -2019// Klaus Schwab, World Economic Forum, /Geneva: –2019, –648 p.

Table 1: Correlation matrix between the components of the IEF, 2023, based on data from 184 countries

Indicator		*x1*	*x2*	*x3*	*x4*	*x5*	*x6*	*x7*	*x8*	*x9*	*x10*	*x11*
Property Rights	*x1*	1										
Judicial Effectiveness	*x2*	0,88	1,00									
Government Integrity	*x3*	0,91	0,88	1								
Tax Burden	*x4*	-0,35	-0,43	-0,40	1							
Government Spending	*x5*	-0,56	-0,54	-0,55	0,36	1						
Fiscal Health	*x6*	-0,08	-0,10	-0,07	0,05	0,11	1					
Business Freedom	*x7*	0,84	0,75	0,81	-0,23	-0,45	-0,04	1				
Labor Freedom	*x8*	0,57	0,62	0,57	-0,19	-0,29	-0,07	0,54	1			
Monetary Freedom	*x9*	0,44	0,39	0,37	-0,08	-0,14	0,04	0,39	0,38	1		
Trade Freedom	*x10*	0,59	0,47	0,52	-0,06	-0,37	0,04	0,68	0,41	0,24	1	
Investment Freedom	*x11*	0,67	0,58	0,61	-0,22	-0,29	-0,03	0,67	0,37	0,43	0,50	1
Financial Freedom	*x12*	0,67	0,57	0,63	-0,21	-0,28	-0,03	0,73	0,41	0,39	0,57	0,80

Source: Compiled and calculated by the author based on the "Index of Economic Freedom – 2023" [9].

Classification of correlation dependency:

Very weak: |r| = 0.00–0.19; Weak: |r| = 0.20–0.39; Moderate: |r| = 0.40–0.59; Strong: |r| = 0.60–0.79; Very strong: |r| = 0.80–1.00. [10]

The general trend shows that improvements in the business environment, property rights, investment environment, financial and trade environment in Azerbaijan during 2010–2023 have yielded positive results. However, there are both very strong and very weak correlations among some economic freedom indicators in Azerbaijan. For some indicators, the dependency coefficient differs significantly from the global coefficient. (See Table 2)

[9] https://www.heritage.org/index/pages/all-country-scores

[10] Field, A. *Discovering Statistics Using IBM SPSS Statistic, 2013*

Table 2: Correlation between the components of IEF in Azerbaijan, 1996–2023

		x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11
Property Rights	x1	1										
Government Integrity	x2	0,71	1									
Judicial Effectiveness	x3	0,54	0,61	1								
Tax Burden	x4	0,29	0,61	0,19	1							
Government Spending	x5	-0,33	-0,32	-0,19	-0,12	1						
Fiscal Health	x6	0,93	0,71	0,33	0,46	-0,48	1					
Business Freedom	x7	0,32	0,62	0,4	0,79	-0,4	0,49	1				
Labor Freedom	x8	-0,19	0,22	0,14	0,57	-0,38	0,03	0,78	1			
Monetary Freedom	x9	0,01	0,15	-0,01	0,75	0,11	0,11	0,4	0,35	1		
Trade Freedom	x10	-0,07	0,14	0,13	0,74	-0,09	0,07	0,64	0,72	0,74	1	
Investment Freedom	x11	0,47	0,68	0,24	0,83	-0,47	0,67	0,84	0,54	0,44	0,49	1
Financial Freedom	x12	0,67	0,73	0,34	0,67	-0,67	0,82	0,77	0,43	0,23	0,34	0,89

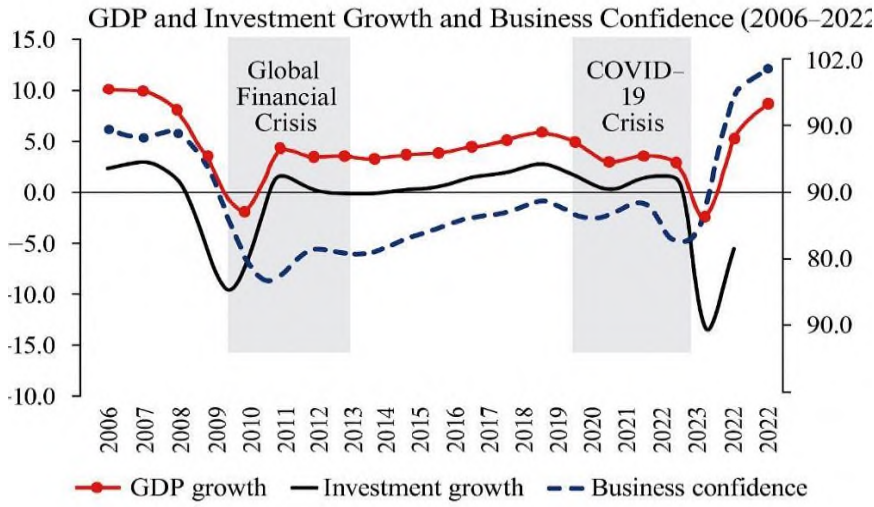
Source: Compiled and calculated by the author based on "Index of Economic Freedom -2023" [11].

Experience shows that it is crucial to consider the influence of macro factors on KE development. Even if all resources (human, financial, etc.) are mobilized, without a favorable economic environment and proper assessment of macro factors, it is impossible to achieve the production of innovative products and services.

A healthy competitive environment, confidence in the future of business, and insurance of innovation risks can encourage the business sector to invest in knowledge development. The formation of trust depends on the government's regulatory policy and the degree of business intervention. A favorable de facto business environment and confidence can increase investment in new business ideas and strengthen the role of knowledge in economic growth.

In Graph 2, a high dependency between GDP growth (%), investment growth (%), and the Mutual Trust Index for OECD countries is observed.

[11] https://www.heritage.org/index/pages/all-country-scores



Graph 2: Dynamics of average indicators for OECD countries *Source: Compiled by the author based on "OECD stat"* [12].

Evaluations show that in OECD countries, there is a very strong and strong correlation between business confidence and GDP and investment growth. Analyses show that mutual trust and economic growth are strongly correlated (r=0.7782), and mutual trust and investment are very strongly correlated (r=0.9077).

Proposition: *The formation, use, and development of HC depend on the overall socio-political environment, the education and healthcare systems, the regulation of macro factors (such as institutions, the business environment, the labor market, etc.), and the social protection system.*

***Scientific Novelty*:** *For the first time, the Human Capital Development Index (HCDI) has been calculated for 92 countries based on a distinct methodology (formation, capitalization, use, and efficiency), and a ranking has been compiled.*

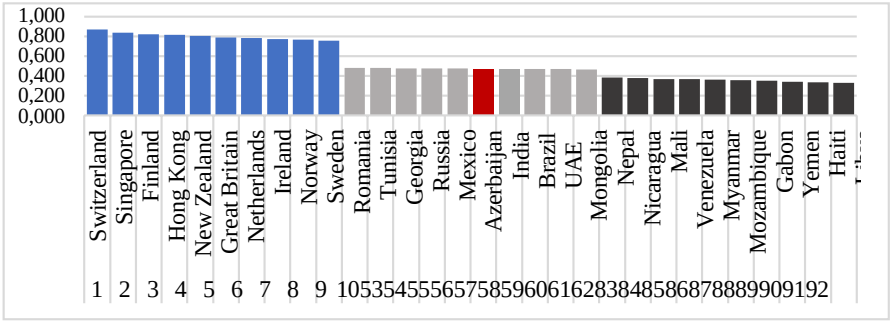
***Scientific Novelty*:** *The total expenditures on the development of HC in Azerbaijan have been calculated, and the synergy effect between*

[12] Trust in government (indicator) [electron resources] / OECD, –2023. URL: https://data.oecd.org/gga/trust-in-government.htm

macro factors and the formation, use, and effectiveness of HC has been evaluated.

Justification: HC is the "central brain" of KE. Without HC of appropriate quality to meet contemporary demands, KE construction can only exist theoretically, as it is humans with specific knowledge and skills who create, disseminate, assimilate, apply, and turn knowledge into economic value. Therefore, the assessment of HC formation, capitalization, use, and efficiency is crucial for understanding the continuity of the process. Considering this, the HCDI was calculated for 62 countries using 48 indicators grouped into 6 blocks reflecting formation, capitalization, use, efficiency, health, and financing. These indicators were normalized into the [0–1] interval using the formula below. Values closer to 1 indicate stronger HC development, while values closer to 0 indicate weaker development.

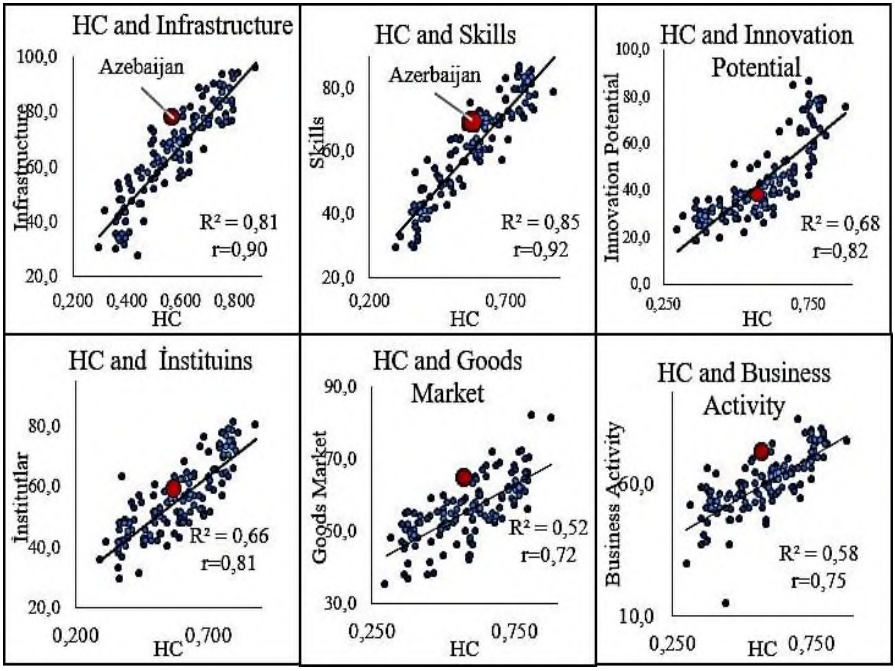
The calculated Human Capital Development Index (HCDI) ranks Switzerland first. Azerbaijan ranks 58th among 92 countries. (See Graph 3)



Graph 3: Human Capital Development Index (based on 2020 indicators)
Note: HCDI calculated by the author.

Research and analysis show that the effective use of HC requires a healthy competitive environment and a competitive market.

The following graphs illustrate the dependencies between indicators with a high probability of influencing HC formation, use, and efficiency. The indicators were taken from the HC Index and the GCI. As can be seen, there is a very strong, strong, and moderate dependency between the sub-indices and the HC Index. (See Graph 4)



Graph 4: Macro factors in interaction with human capital, 2019[13], for 132 countries

Source: Prepared by the author based on the World Bank HC Index and the World Economic Forum GCI[14] materials.

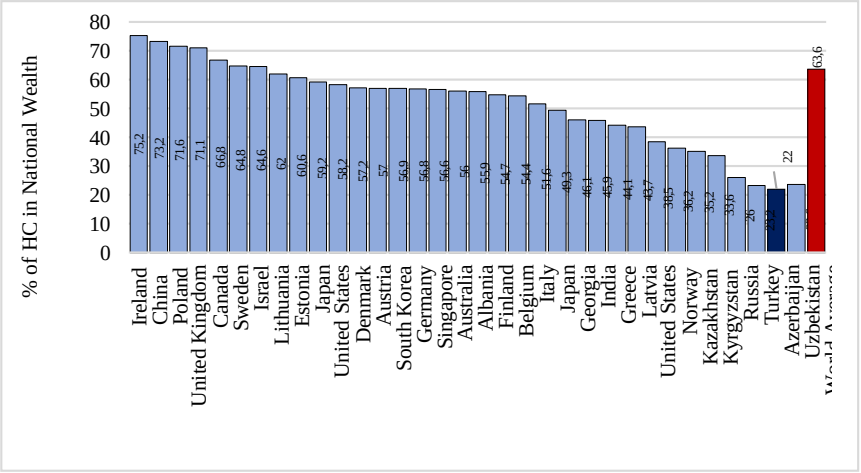
As observed, Azerbaijan lies above the trend line for all factors except innovation potential. However, there are certain challenges in the formation and use of HC, as well as in the regulation of macro factors. Existing problems related to macro factors may pose significant long-term obstacles to the formation and development of KE in the country.

One of the important indicators for assessing the role of HC in the development of society and the economy is the share of human capital in national wealth. The World Bank's *The Changing Wealth of Nations*

[13] The Human Capital Index 2020 UPDATE: Human Capital in the Time of COVID-19 // orld Bank, –The World Bank Group, Washington: 2021, 203 p

[14] Schwab, K. The Global Competitiveness Report 2019 // K.Schwab, –World Economic Forum, –Genev: – 2019. – 647 p

– *2021*[15] report presents the structure of national wealth by country. National wealth is assessed based on produced capital, human capital, renewable natural capital, non-renewable natural capital, and net foreign assets. Ireland (75.2%), China (73.2%), and Poland (71.6%) lead in terms of the share of HC in national wealth per capita. The share of HC in Turkey's national wealth is 26.0%, while in Azerbaijan, it is only 23%. (Graph 5)



Graph 5: The share of human capital in the per capita national wealth of several countries, %, 2018

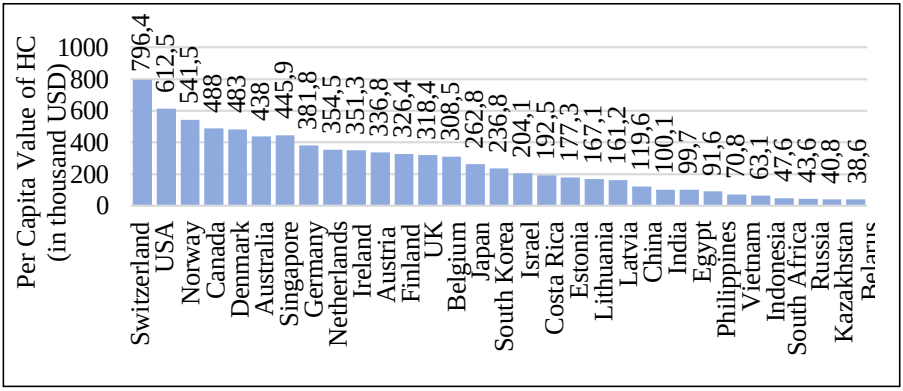
Source: Prepared by the author based on World Bank, 2021.

In general, in most resource-rich countries, including Azerbaijan, the share of HC in national wealth is relatively low. The main reason for this is the high share of natural capital in total wealth. Undoubtedly, the underdevelopment of HC in these countries also affects the results.

Statistical evaluations show that the per capita value of HC in Azerbaijan is significantly lower compared to the countries analyzed. In 2018, the value of per capita national wealth in Azerbaijan was USD 36.3 thousand, while the value of HC per capita was USD 8.4 thousand. Globally, the per capita value of HC is USD 101.8 thousand,

[15] The Changing Wealth of Nations 2021: Managing Assets for the Future. // World Bank. Washington, DC: The World Bank Group, 2021, 456 p.

which is approximately 12 times higher than Azerbaijan's indicator. (See Graph 6



Graph 6: Per capita value of human capital in selected countries, USD thousand

Source: Prepared by the author based on World Bank, 2021.

The economic environment in Azerbaijan also significantly influences the use of HC and the transformation of acquired knowledge into economic value. Here, institutions, infrastructure, the wage system, the business environment, and other factors play an important role. The rapid development of new techniques and technologies leads to the creation of jobs requiring intellectual labor, which, in turn, necessitates the training of specialists with new knowledge and skills.

The formation of HC mainly occurs through education, training, and practice. According to our calculations, the total expenditure on the capitalization of human potential in Azerbaijan amounted to AZN 9.8 million in 2022, or AZN 977 per capita. Of these expenses, AZN 569.8 were covered by the state budget, AZN 407.2 by households, and AZN 1.18 by organizations.

Compared to 2001, the per capita expenditures from the state budget increased 14.9 times in 2022, while household per capita expenditures increased 24.2 times. This shows that both the state and the population are interested in investing in HC. However, the same cannot be said for enterprises and organizations. Enterprises and organizations are still not very interested in investing in the training and retraining of

employees. The reason for this could be the weak stimulation mechanisms and the macro factors mentioned earlier.

Table 3: Expenditures on HC formation in Azerbaijan *Note: Table calculated by the author.*

	Total expenditures on Human Capital (mln. AZN)	Including expenditures by source, mln. AZN			Distribution of HC expenditures by source, %			Per capita HC expenditures by households, AZN	Per capita HC expenditures from the budget, AZN	Share of HC expenditures in GDP, %	Share of HC expenditures in budget expenditures, %	Share of HC expenditures in R&D expenditures, %
		Households	State Budget	Enterprises and Organizations	State Budget	Households	Enterprises and Organizations					
1	2	3	4	5	6	7	8	9	10	11	12	13
2001	443,4	135,6	307,8	0	69,4	30,6	0	16,8	38,1	8,3	38,1	4,4
2005	1145	453,5	691,1	0	60,4	39,6	0	54	82,3	9,1	32,3	6,78
2010	3414,7	1234,7	2174,2	5,8	63,7	36,2	0,17	138	243	8	18,5	7,8
2015	6001,3	2860,5	3129,8	11	52,2	47,7	0,18	300	328,2	11	17,6	10,18
2016	6852	3114,8	3724,6	12,6	54,4	45,5	0,18	322,8	386	11,3	21	10,16
2017	6557,1	3184,9	3362,7	9,5	51,3	48,6	0,14	326,4	344,6	9,3	19,1	9,78
2018	7067,4	3334,6	3721,2	11,6	52,7	47,2	0,16	338,4	377,6	8,8	16,4	9,86
2019	7832,2	3518,7	4301,9	11,6	54,9	44,9	0,15	354	432,8	9,6	17,6	9,89
2020	8480,9	3527,6	4947,5	5,8	58,3	41,6	0,07	355,2	498,2	11,7	18,7	9,94
2021	8795,9	3792	4994,7	9,2	56,8	43,1	0,1	379,2	499,5	9,4	18,2	10,24
2022	9825,5	4089,8	5723,8	11,9	58,3	41,6	0,12	407,2	569,8	7,3	17,9	10,18
2001=1	**22,2**	**30,2**	**18,6**	-	-	-	-	**24,2**	**14,9**	-		

Note: The table has been calculated by the author.

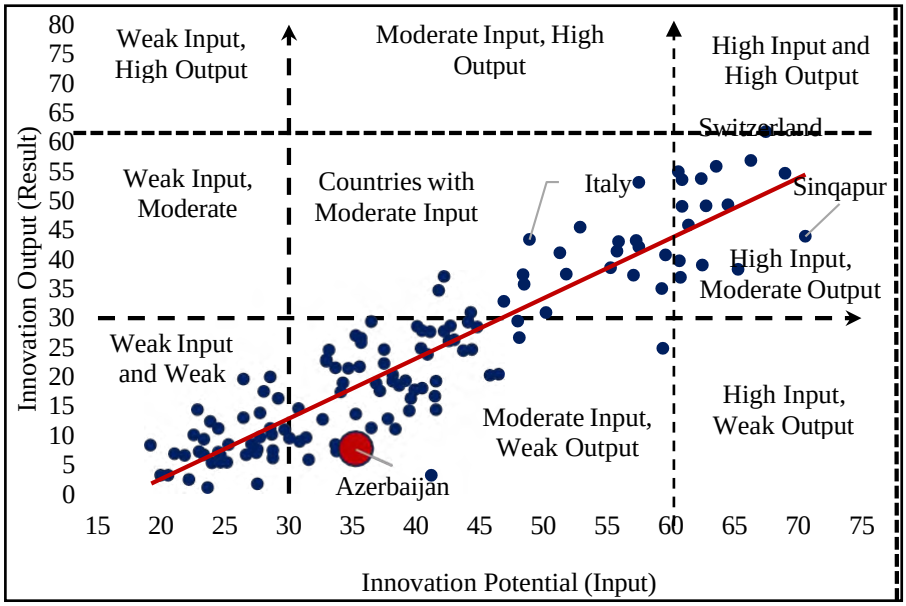
Proposition: *Although Azerbaijan possesses certain potential for innovative development (HC, investment, infrastructure, etc.), the level of utilization of this potential remains low.*

Scientific Novelty: *It has been substantiated that there is a strong relationship between innovation-investment activity and KE, the de facto business environment, trust, institutional efficiency, protection of property rights, as well as stimulating and incentivizing mechanisms.*

Justification: Innovation-investment activity lies at the core of enhancing the role of knowledge in economic development. Reports by international organizations also highlight innovation-investment activity as one of the main trends of the modern era. The Global Innovation Index (GII) is used to assess and compare innovation activity across countries. This index is grouped into two main components: innovation input (potential) and innovation output (results). It should be noted that in 2022, compared to 2021, Azerbaijan dropped 13 positions in the

overall ranking, 4 positions in the innovation input block, and 19 positions in the innovation output block. This decline serves as a serious signal for the country under the current circumstances.

In the research, countries were grouped based on their innovation potential and innovation outcomes according to the GII. Countries with an index value above 60.0 have high innovation development, those between 30.0–60.0 have moderate innovation development, and those below 30.0 have weak innovation development. (See Graph 7)



Graph 7: Linear relationship between GII input and output blocks
Source: Compiled by the author based on the Global Innovation Index Report[16].

As can be seen from the graph, Switzerland is the only country with high input and output parameters. Overall, the average of countries'

[16] Global Innovation Index-2022: What is the future of innovation-driven growth // editors: Soumitra S. Dutta, B Lanvin, L.R.León and S. Wunsch-Vincent/ – Geneva WIPO: – 2022 –262 p.

input indicators is higher than that of their output indicators. Naturally, without innovation potential, there will be no innovation outcomes. Countries with weak input and output parameters are also economically underdeveloped. Azerbaijan is positioned below the trend line. It falls into the group of countries with moderate input but weak output indicators, indicating that although Azerbaijan has moderate innovation potential, this potential is not being used effectively. If the efficiency of using innovation potential and the regulation of macro factors is improved, Azerbaijan could move into the group of countries with moderate input and output indicators.

In Chapter Five of the dissertation, entitled "Analysis of the Current State of the Education, Science, and Information Sectors (ESİS) in Azerbaijan and Evaluation of Their Impact on Knowledge Development," the current state of education services is analyzed, and their interrelation with macro factors is assessed. The evaluation of the education system in Azerbaijan is carried out based on both quantitative and qualitative parameters. This chapter also examines the relationship between the scientific potential, the current state and development indicators of the ICT sector, and macro factors, leading to important findings.

Proposition: *The formation and development of KE depend not only on the internal conditions of educational services but also significantly on the efficient use of education-related expenditures and the influence of external system factors.*

Scientific Novelty: *It has been substantiated that there is a strong synergy effect between the quality and economic efficiency of education, macro factors (such as institutions, the business environment, trust, the labor market, etc.), and the development of knowledge.*

The effectiveness of educational services can be assessed based on input and output parameters such as quantity, quality, and usefulness. It is important to focus on all three parameters when regulating educational services.

Education financing directly influences the quality of services. Since independence, education expenditures in Azerbaijan have steadily increased. Compared to 2000, the amount allocated to education from the state budget increased 20.3 times in 2022, rising from AZN

181 million to AZN 3.6 billion. In 2022, the ratio of state education expenditures to GDP was 2.76% (3.5% in 2001) and to total budget expenditures was 11.5% (23.0% in 2001).

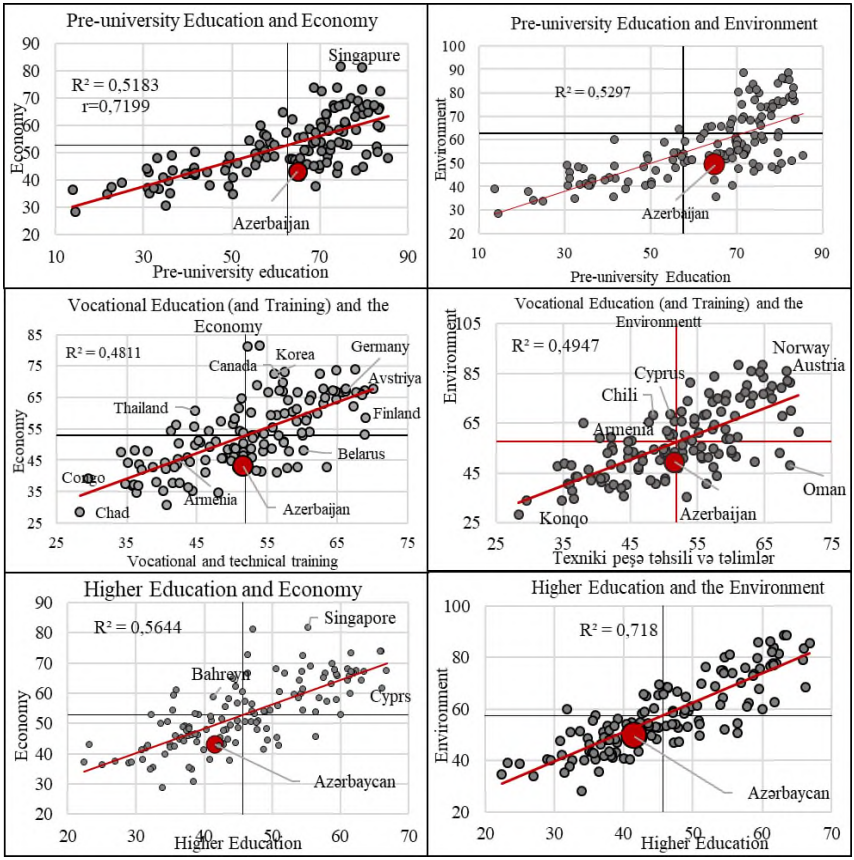
It should be noted that household spending on education has also significantly increased. Compared to 2001, household expenditures on education rose 16 times in 2022, from AZN 38 million to AZN 644.8 million.

Analyses show that the share of expenditures in GDP is not sufficient to assess the real situation. Therefore, it is more appropriate to use per capita education expenditures and per capita GDP indicators for evaluation. Luxembourg leads globally in terms of per capita education spending, with USD 5.8 thousand per person annually, followed by Sweden (USD 4.4 thousand), Norway (USD 4.0 thousand), Denmark (USD 3.8 thousand), Estonia (USD 1.5 thousand), and Azerbaijan (USD 0.2 thousand). High per capita education expenditures significantly influence economic growth and development.

In Azerbaijan, about AZN 60–70 thousand is spent on each student over 15–20 years of education (including higher education), which is approximately AZN 4,000 annually. This figure is naturally much higher in developed countries. In 2020, per-student spending was USD 52,000 in Luxembourg, USD 35,300 in the USA, USD 29,700 in the UK, USD 9,500 in Turkey, USD 9,000 in Russia, and USD 4,200 in Greece.

According to the results of PISA 2018, Azerbaijan ranked 68th out of 77 countries in reading skills (389 points), 55th in mathematics (420 points), and 67th in science (398 points).

Analyses indicate a high correlation between vocational and higher education and economic development and environment (See Graph 8).



Graph 8: Relationship between pre-university education, vocational education, higher education, environment, and competitive economic development

Source: Compiled by the author based on Global Knowledge Index[17] (GKI) data.

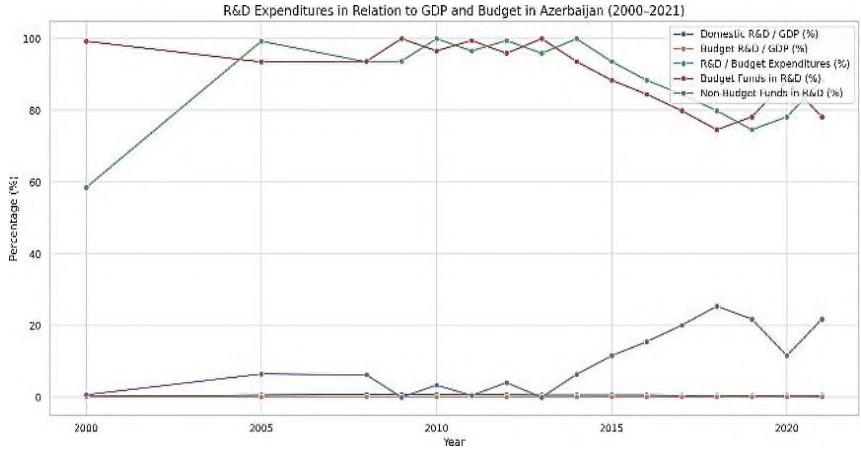
Proposition: *In Azerbaijan, the link between research activity and the business sector is very weak, and it significantly depends on the de*

[17] Global Knowledge Index: 2022. [electron resources] / United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Knowledge Foundation, – 2023. –URL: https://www.knowledge4all.com/country–profile?CountryId=1007

facto favorability of the business environment and the level of trust in business.

Scientific Novelty: *It has been substantiated that there is a strong cause-and-effect relationship between the development of science and the de facto favorability of the business environment, trust, and other related factors.*

The most widely used indicator for assessing the level of scientific development in countries is the ratio of domestic expenditures on research and development (R&D) to GDP. According to international standards, this ratio should exceed 2% to ensure scientific development and increase the economic usefulness of research. A ratio below 1% is considered critical. In Azerbaijan, this ratio was only 0.2% in 2021 (0.3% in 2000), which is significantly lower than the critical threshold. Although the volume of R&D expenditures has increased over the past 23 years, its share in GDP has not changed. Moreover, the ratio of budgetary R&D expenditures to GDP fell from 0.2% to 0.16%. Budgetary expenditures on science accounted for 0.55% of the total state budget (1.2% in 2000) (See Graph 10).



Graph 9: Financial Indicators of R&D in Azerbaijan
Source: Compiled by the author based on data from the State Statistical Committee of Azerbaijan.

Between 2000 and 2021, internal expenditures on science in Azerbaijan increased by 12.2 times (from 15.9 million AZN to 194.2 million AZN), state budget expenditures increased by 16.3 times (from 9.3 million AZN to 151.8 million AZN), and non-budget funds increased by 6.4 times (from 6.6 million AZN to 42.4 million AZN). In 2021, the share of budget funds in total internal expenditures on R&D was 78.2% (compared to 58.5% in 2000 and 100% in 2010), while the share of non-budget funds was 21.8% (41.5% in 2000 and 0% in 2010).

As can be seen, the share of extra-budgetary funds (such as business, universities, foundations, etc.) in the financing of R&D in Azerbaijan remains low. However, in most countries around the world, the business sector holds a dominant share in the funding of R&D.

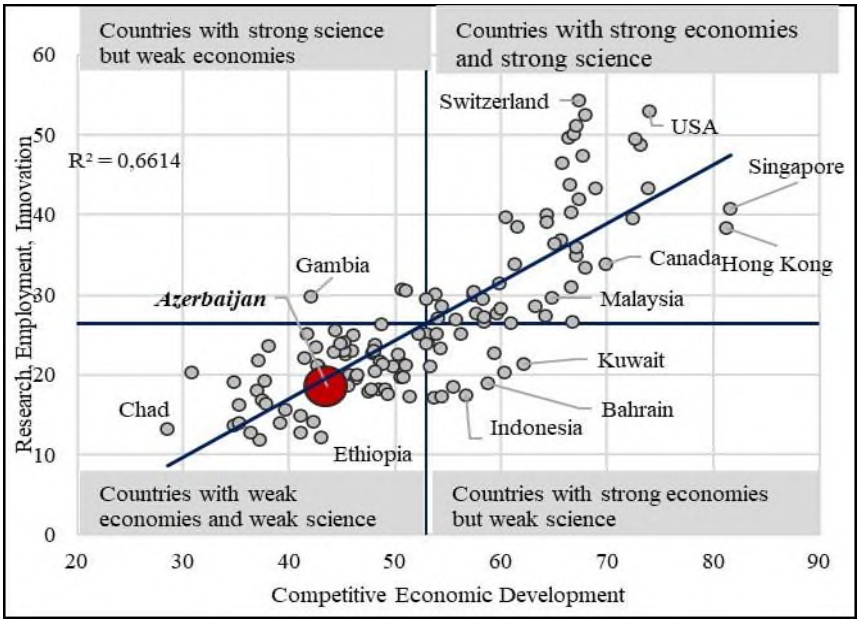
For example, in countries leading the high-tech markets, the ratio of R&D expenditures to GDP exceeds 2%. In 2020, this ratio was 5.3% in Israel, 4.8% in Korea, and 3.49% in Sweden. In comparison, the ratio was 0.23% in Azerbaijan, 0.32% in Georgia, 0.15% in Uzbekistan, and 0.13% in Kazakhstan. The global average is about 1.93%.

However, the ratio of R&D expenditures to GDP is sometimes insufficient to assess scientific development. A more appropriate indicator is the amount of expenditure per researcher. In 2020, the expenditure per researcher was USD 373.8 thousand in the USA, USD 116.4 thousand in Russia, USD 100.3 thousand in Turkey, USD 56.9 thousand in Lithuania, and only USD 13.2 thousand in Azerbaijan.

According to OECD statistics, in 2021, per capita R&D expenditures were USD 2,448 in Israel, USD 2,426 in the USA, USD 2,320 in Switzerland, USD 2,312 in Korea, USD 347 in Turkey, USD 327 in Russia, USD 54 in Poland, USD 242 in Latvia, and only USD 26.1 in Azerbaijan. It should be noted that there is a high correlation between per capita R&D expenditures and per capita GDP.

In developed countries, the largest share of R&D expenditures comes from the business sector: Belgium (64.3%), Ireland (62.8%), Germany (62.6%), Sweden (62.4%), Japan (78.3%), Korea (76.6%), China (77.5%), and the USA (66.3%). In most post-socialist and post-Soviet republics, the share of the business sector in R&D is below 50%. In Azerbaijan, this figure is approximately 3.3%.

The following chart (Graph 10) presents a four-block typological model illustrating the relationship between competitive economic development and the development of science.



Graph 10: The 4B Typological Model of the Relationship Between Competitive Economic Development and R&D

Source: Compiled by the author based on GKI data.

In recent years, some revival has been observed in the development of science in Azerbaijan. However, the main problems include the lack of orders for research projects from both the public and private sectors, the absence of market infrastructure in the scientific field, the low innovation activity of enterprises, and the lack of stimulating mechanisms in tax legislation. All these factors have led to limited financial resources for science.

Proposition: *The development of KE largely depends on the level of collection, processing, storage, language, speed, and accessibility of information—scientific, technical, and technological..*

Scientific Novelty: *The synergy effect between KE development, the provision of society with essential (scientific-technical, technological, etc.) information, and macro factors has been evaluated.*

Currently, countries (as well as companies and individuals) that make more effective use of ICT capabilities are developing at a faster pace. In the theoretical part of this research, we have discussed the social, economic, and political importance of information provision and its influence on the business environment, competitiveness, and economic development. Additionally, information is also used as a psychological weapon. Currently, the world is experiencing a very serious and significant information war. It should also be noted that ICT or information infrastructure is just a tool (machine) for obtaining, processing, transmitting, and storing information. For this machine to function effectively, other factors are necessary, such as state support mechanisms, effective regulation, quality infrastructure, a favorable business environment, and the development of knowledge and skills.

Information can also be obtained through traditional methods. However, this is very costly and time-inefficient. The ICT sector significantly improves the efficiency of obtaining, transmitting, and accessing information and creates institutional links.

In Azerbaijan, there is a significant need for scientific, technical, and technological information (electronic resources) in the Azerbaijani language. Internet-based analyses reveal that electronic resources in Azerbaijani (scientific studies) are fewer compared to neighboring countries. A search in 20 languages on global problems and priority areas of science showed a "scientific information hunger" in the Azerbaijani language. This seriously limits students' and learners' access to modern knowledge. This problem can be considered a serious obstacle to the construction of a knowledge-based economy. Translating scientific, technical, and technological innovations and fundamental research results into Azerbaijani and making them available to students and learners could accelerate knowledge development in the country.

In the sixth chapter of the dissertation, titled **"Measuring the Level of Liberalism and Dirigisme in Knowledge Economy Construction: Methodology and Cross-Country Comparative Evaluation**," the level of liberalism–dirigisme in knowledge-related activities—

namely education, science, information, and innovation—has been assessed. The evaluation is based on the idea of the Economy Left (Right) Index – EL(R)I, developed at the Institute of Economics of the Ministry of Science and Education.

A methodology was developed to measure the level of liberalism–dirigisme in KE, and based on this methodology, the degree of state intervention in education services, scientific activity, information provision, and innovation was measured across 62 countries. As a result, the "Knowledge Economy Liberalism–Dirigisme Index" (KELDİ) was calculated.

In the calculation of KELDİ, indicators reflecting the share of the state and the private sector in financing, employment, and ownership structures in the fields of education, science, information provision, and innovation were used.

KELDİ was calculated based on four sub-indices. The following formula was used for the normalization of indicators**:**

$$\dot{I}_{lib-dirj.} = \frac{(\dot{I}_{fak} - \dot{I}_{min})}{(\dot{I}_{max} - \dot{I}_{min})} \quad (2)$$

Here, I_{fact} refers to the actual value of the indicator; I_{max} is the maximum value among the measured variables; and I_{min} is the minimum value among the measured variables. This method normalizes the indicators within a range from "0" to "1". A value closer to "0" indicates a higher level of liberalism, while a value closer to "1" indicates a higher level of dirigisme.

In the next stage, KELDİ was calculated by taking the arithmetic mean of the four sub-indices.

$$\text{KELDİ} = \frac{\text{ESLD}_{\text{sub-index}} + \text{SALD}_{\text{sub-index}} + \text{IALD}_{\text{sub-index}} + \text{IPLD}_{\text{sub-index}}}{4} \quad (3)$$

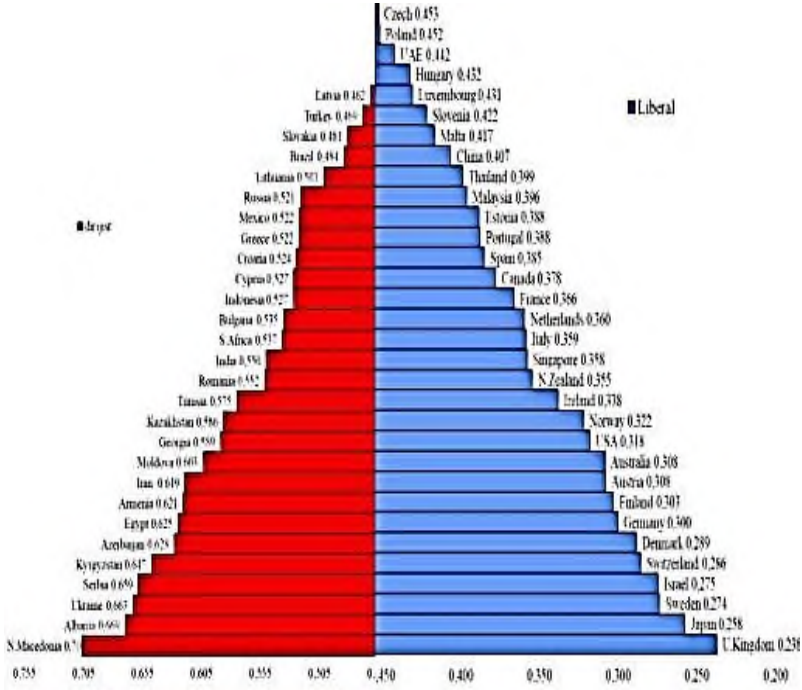
Based on the obtained results, the countries involved in the study (62 countries) were polarized according to the level of liberalism–dirigisme in KE. Countries with a KELDİ score above the average were classified as dirigiste, while those below the average were classified as liberal. The outcomes of this calculation are logically consistent and

provide a general basis for identifying whether the sectors are predominantly liberal or dirigiste in nature.

Proposition 1: *Accelerating the formation of KE requires the implementation of a liberal-oriented regulatory policy, which stimulates the development of knowledge..*

Scientific Novelty**:** *For the first time, the Knowledge Economy Liberalism–Dirigisme Index (KELDİ) was calculated, and the necessity of a liberal approach for KE was substantiated.*

Justification: The actual average of the KELDİ (0.455) is slightly lower than the theoretical average (0.500) and shifts slightly towards the liberal pole. This result shows that countries that have achieved KE are generally located in the liberal pole, while countries where the role of knowledge in the economy is weak tend to be in the dirigiste pole. (See Graph 11)



Graph 11: Grouping of countries by KELD Index (60 countries)

Note: Compiled by the author.

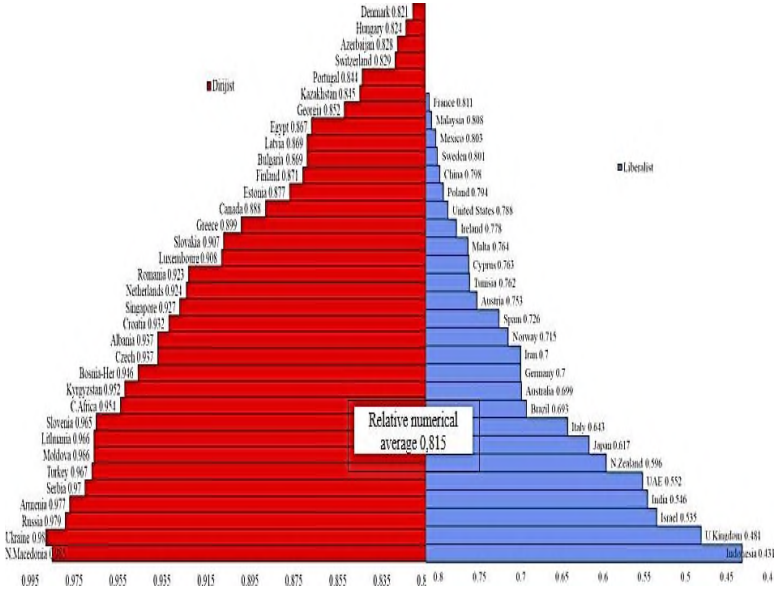
Azerbaijan ranked as the 6th most dirigiste country according to KELDİ. With an index score of 0.628, Azerbaijan deviated 0.173 points toward dirigisme from the actual arithmetic mean. Based on the obtained results, it can be concluded that there is a need for the liberalization of the science, innovation, and information provision systems in Azerbaijan.

Proposition: *It is essential that the education system—particularly pre-university education—be based on dirigiste regulation, while university-level education be grounded in a liberal regulatory approach.*

Scientific Novelty: *For the first time, the ESLD Index was calculated, and the importance of the education system being generally dirigiste was substantiated.*

Justification: The ESLDİ was calculated using indicators such as the share of public sector expenditures in total education expenditures and the share of the public sector in the total number of students. (See Graph 12)

Graph 12: Grouping of countries by ESLD Sub-index (60 countries)



Source: Calculated based on World Development Indicators.

With an index score of 0.828, Azerbaijan occupies a position close to the actual arithmetic mean—i.e., the relative center. Compared to almost all post-Soviet and post-socialist countries, state intervention in the education system in Azerbaijan is relatively more liberal. Azerbaijan deviates 0.328 points from the theoretical mean and only 0.013 points from the actual mean toward the dirigiste pole.

The scope and compulsory nature of education increase its dirigiste weight. At the same time, ensuring access to education is considered a strategic step for the future development of states.

Proposition: *A high degree of liberalism in scientific activity and the flexibility of incentive mechanisms are essential conditions for the development of knowledge.*

Scientific Novelty: *For the first time, the SALD İndex was calculated, and the importance of a liberal approach for the development of science was substantiated.*

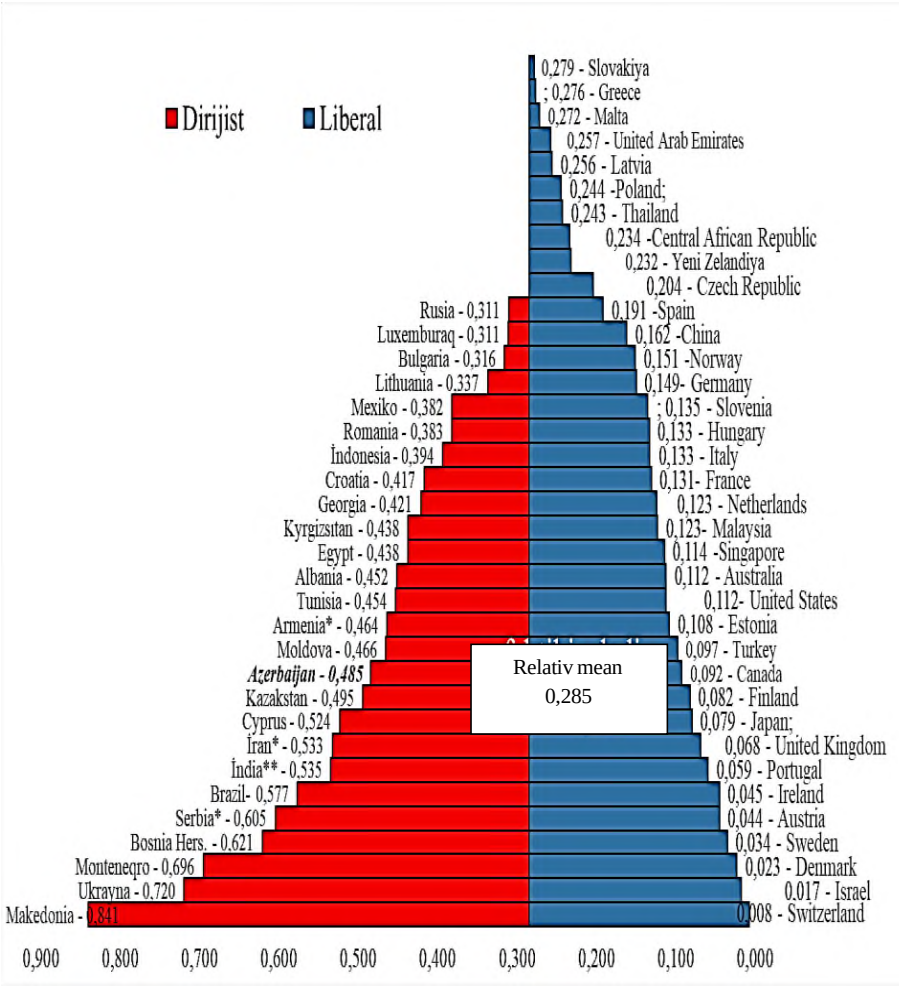
Justification: The SALDİ was calculated using indicators such as the share of private sector research institutions, private sector share in science expenditures, and the share of private sector patents.

The results show that most countries are located in the liberal pole, confirming that a liberal-oriented science system is essential for scientific development and KE construction. (See Graph 13)

Azerbaijan, with a value of 0.485, is placed in the dirigiste pole. The obtained value is 0.200 points higher than the actual average, indicating the need for liberalization in the country's science system.

Proposition: *For innovation activity to be effective, it is essential that the elements of the National Innovation System (NIS) be regulated primarily through liberal and incentive-based approaches..*

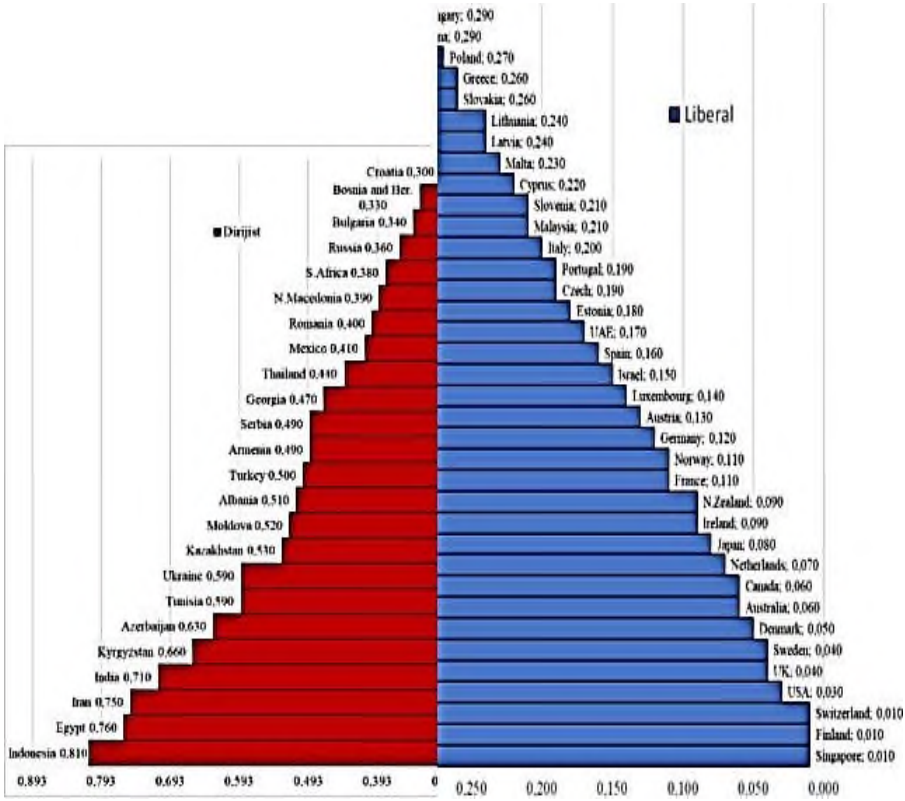
Scientific Novelty**:** *For the first time, the IALD Index was calculated, and the importance of a liberal and flexible approach to the regulation of innovation activity was substantiated..*



Graph 13: SALD Sub-Index (62 countries)
Source: UNESCO and OECD statistics.

Justification: The index was calculated based on the sub-indicators of the *Global Innovation Index*, including applied incentives, innovation entrepreneurship, private sector innovation expenditures, and the private sector's share in innovation output.

The results show that most countries are grouped in the liberal pole. The actual average shifted 0.207 points toward the liberal pole compared to the theoretical average. (See Graph 14)



Graph 14: IALD Sub-Index (60 countries)
Source: Cornell University, INSEAD, and WIPO.

The result indicates that the development of innovation activity requires a liberal orientation. Azerbaijan, with an index of 0.630, is positioned in the dirigiste pole. Countries with a liberal national innovation system are mainly developed countries, and this factor is decisive in KE construction.

Proposition: *The regulation of information provision based on liberal and incentive-driven principles is a key condition for ensuring the accessibility of information products.*

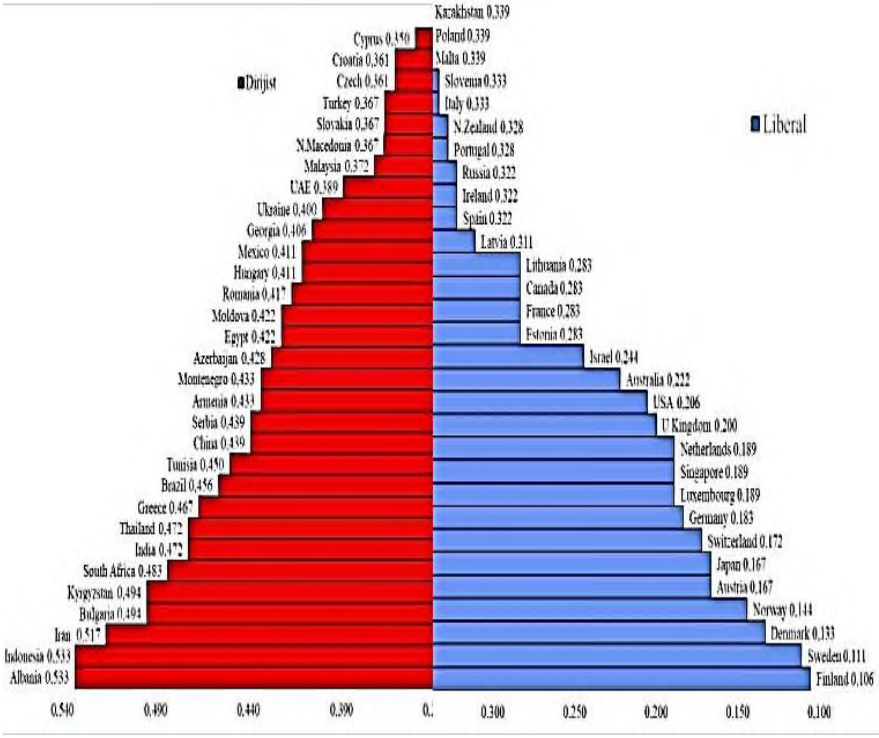
Scientific Novelty: *For the first time, the IPLDİ was calculated, and it was substantiated that scientific, technical, and technological information is more accessible within a liberal system.*

Justification: Today, ICT plays a crucial role in ensuring access to the information necessary for both society and the development of human capital. ICT is not only essential for enhancing information provision but also represents one of the key sectors that directly and indirectly contributes to the formation of KE.

In a broader sense, liberalism in information provision implies both the physical and economic accessibility of information.

The IPLDI was calculated based on sub-indicators derived from the Global Network Readiness Index, including information accessibility, access to the information space, internet tariffs, and the private sector's share in the information provision system.

The actual average value of the IPLDI (0.340) deviated toward the liberal pole compared to the theoretical average (0.500). (Graph 15)



Graph 15: IPLD Sub-Index (61 countries)
Source: Calculated by the author based on Global Information Technology Report and ITU data.

Azerbaijan, with an index value of 0.428, ranks as the 17th most dirigiste country. The result shows that compared to dirigiste models, a liberal economic model has more positive impacts on KE construction. A liberal economic system provides a solid foundation for KE development.

In Chapter 7, titled **"Directions for Improving the Impact of Macro Factors on the Formation and Development of the Knowledge Economy in Azerbaijan,"** the mechanism for regulating the interaction of the driving forces behind KE is presented. A schematic illustration is provided showing the interrelations and synergy effects of liberal–dirigiste approaches to the regulation of macro factors, ESİS, HC, and innovation–investment activity. Key directions for the regulation of KE are also outlined.

Proposition: *When economic and non-economic macro factors, the quality of HC, ESİS, and innovation–investment activity are effectively interconnected, the efficiency coefficient of the KE "engine" increases. In this context, it is essential that the elements which "activate" the engine are regulated in a dirigiste manner, while those which "accelerate" it are regulated through liberal approaches.*

Scientific Novelty: *For the first time, a model has been proposed to increase the efficiency of the KE "engine" through a balanced combination of dirigiste and liberal regulatory mechanisms. The relationship between "demand pressure" and "knowledge pressure" has been substantiated, along with the importance of applying a dirigiste approach during the formation phase and a liberal approach during the development phase of KE.*

The education system influences the development of human capital, and human capital, in turn, affects the development of knowledge. At the same time, dirigiste and liberal regulatory mechanisms impact the efficiency of these elements.

Two main regulatory approaches—dirigiste and liberal—are presented here. The general conclusion is that a dirigiste approach is necessary during the formation phase, while a liberal approach is more appropriate in the development phase. (Figure 2)

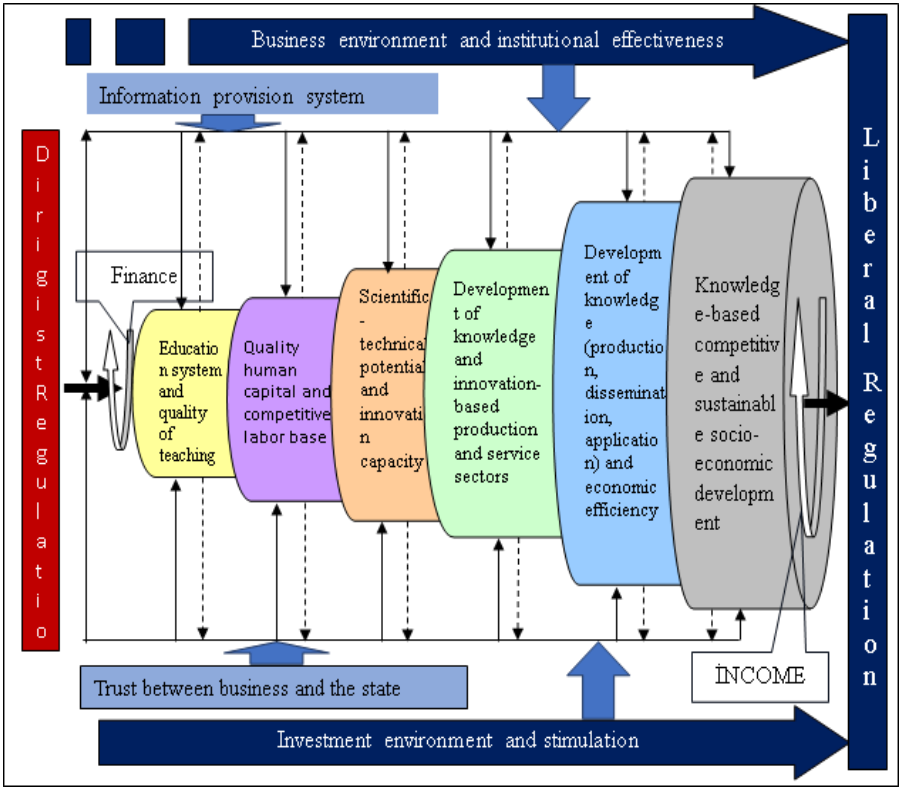


Figure: Mechanism of Interaction Between KE Components and Macro Factors(*Author's design*)

The "engine" of KE is the effective interaction between the above-mentioned elements and regulatory mechanisms. This interaction accelerates the processes of knowledge creation, dissemination, and application, thereby driving economic growth.

In the chapter **titled "Directions for Regulating the Activities of Key Stakeholders in Knowledge Development in Azerbaijan**," directions are provided for improving the regulation of education services, advancing science, commercializing research outcomes, and enhancing the information provision system for society.

GENERAL RESULTS

Theoretical and Practical Results:

1. The transition from one stage of societal development to another, along with all revolutionary changes and the shortening of periods between stages, has been made possible by the development of knowledge. Since the mid-20th century, knowledge has become one of the most critical factors for competitive economic development, employment, and improving social welfare.

2. Worldview, cognition, and knowledge are not limited to an individual's experience and perspective but are the cumulative resource of human civilization. Unlike other production factors, knowledge increases and becomes more effective through use, while unused knowledge turns into an inert "raw material," the quality of which depends on people's cognitive level and worldview, yielding various socio-economic outcomes.

3. Unlike material production, it is difficult to determine the exact amount of expenditure on knowledge production, as it cannot be measured as a socially necessary labor product. New knowledge is a unique value, irreplaceable by others.

4. The post-industrial society is characterized by the dominance of the service sector, while the knowledge society is marked by the predominance of knowledge in all areas, especially the economy.

5. The formation and development of KE depend on the synergy effect of several economic and non-economic factors. Regulatory effectiveness, the influence of macro factors on various sectors, trust between the government and business, protection of property rights, institutional robustness, and the quality of legislative and regulatory documents play crucial roles.

6. Human capital is formed through investments in human potential, aimed at its reproduction and the enhancement of knowledge and skills. Efficient utilization of HC leads to the formation and development of KE.

7. Education, science, and information systems are the main pillars driving the KE "engine" and are highly sensitive to macro factors. If the education level is low, the importance of science, innovation, and information factors diminishes.

8. The general theoretical conclusion is that dirigiste approaches are needed in the formation phase of KE, while liberal approaches are more effective during the development phase. Combining these approaches ensures both efficient state intervention and the functioning of market forces.

9. Research shows that the de facto favorability of the business environment is more critical than its de jure favorability. De facto favorability enhances confidence in the business sector and investment attractiveness.

Solutions and Policy Recommendations

The formation and development of KE require the implementation of multidimensional reforms and the effective and targeted use of regulatory instruments widely applied in global practice. At present, in order to strengthen the "market–education–science–innovation–information–market" chain, it is essential to establish an optimal regulatory framework at both macro and sectoral levels.

The reforms and measures necessary for the realization of KE in the short and long term may include the following:

Recommendation 1. Training programs aimed at developing public thinking, especially among children and youth, should be designed and integrated into all levels of education to foster a transformation in worldview.

Justification: Changing worldview requires the joint efforts of state institutions and civil society. This process is directly dependent on the organization of teaching, training, and awareness-raising. Research shows that the formation of a value system in society depends on the development of public thinking, which constitutes a foundational prerequisite for the formation of KE.

Expected Outcome: The formation of a society characterized by behavioral culture, healthy social relations, a creative environment, scientific thinking, and intellectual values.

Recommendation 2. Existing laws and normative acts that regulate the development of KE (e.g., “On Education,” “On Science,” etc.) should be improved, and new legislation should be adopted.

Justification: The current legal and regulatory framework contains significant gaps in key areas of KE—such as innovation, technology

transfer, venture financing, and commercialization. To accelerate KE development in Azerbaijan, it is necessary to adopt new laws, including: *"On Innovation Activity," "On Venture Activity," "On Technoparks," "On Small Innovation Entrepreneurship," "On Innovation Fund," "On Information Provision," "On Technology Transfer," "On Startup Incentives," "On the Commercialization of Scientific Research,"* and *"On Higher Education"*.

Expected Outcome: New legislation will reduce legal and institutional barriers, ensure legal protection for innovation activities, and enhance the role of knowledge in economic growth.

Recommendation 3. An "Intellectual Monitoring System for State Regulation" (IMS-SR) based on modern technologies can be established to assess the macroeconomic and social impacts of ongoing reforms.

Justification: Measuring the macroeconomic and social impacts of reforms, adopted laws, regulatory decisions, and legal acts—based on monthly indicators and surveys—is essential for ensuring sustainable development. Such an assessment would help identify the direction of reforms (liberal or dirigiste), determine the optimal regulatory framework, and allow for sectoral and regional evaluation. The methodology of the "Economy Left (Right) Index – EL(R)I," developed by the Institute of Economics of the Ministry of Science and Education, may be useful in building this system.

Expected Outcome: The system will enable the assessment of the real effects of state regulatory policies and enhance the formulation and coordination of flexible policies. The application of IMS-SR could reduce the decision-making time by approximately 35–40%.

Recommendation 4. Incentive and stimulation mechanisms should be implemented in the form of pilot projects for specific sectors and product groups based on the outcomes of the IMS-SR.

Justification: Research shows that generalized incentive measures are often ineffective in fostering knowledge- and innovation-based development. Within the proposed sector- and product-based approach, various forms of support—such as tax exemptions, subsidies, reduced social payments, or insurance mechanisms—should be tailored to the nature of innovation. OECD experience demonstrates that sector- and

product-specific incentive models can increase innovation outcomes by up to 1.7 times.

Expected Outcome: Sector- and product-based incentive mechanisms will enhance knowledge production and application, boost innovation activity, and increase the share of domestic innovative products.

Recommendation 5. A liberal regulatory approach should be prioritized in the governance of science and innovation, and private sector investments in these areas should be actively encouraged.

Justification: A liberal economy, a de facto favorable business environment, and effective institutions play a significant role in the development of scientific and innovation activities. The experience of leading countries shows that, in addition to increasing public expenditures on R&D and innovation, stimulating private sector investment in science and innovation enhances the role of knowledge in economic growth. Measures such as tax credits and innovation risk insurance are applied to support this process. In the context of Azerbaijan, it is advisable that the proposed incentives and exemptions be time-limited and targeted at specific products and services.

Expected Outcome: Private sector investment in science and innovative ideas will increase, accelerating the commercialization of scientific research.

Recommendation 6. To improve the quality of educational services, teaching technologies should be modernized across all levels of education, and university admission procedures should be revised.

Justification: The quality of educational services requires strong state oversight mechanisms. In advanced countries, the education system is aligned with current standards, infrastructure is strengthened, and reforms are implemented to enhance teaching quality and reduce student workload. Online education platforms, digital tools, and virtual classrooms should be used to develop students' independent learning skills.

In the current context, simplifying the university admission process (excluding government-funded placements), expanding the "entrance

gate" to universities, and narrowing the "exit gate" may positively affect knowledge and HC development. Alongside admission, graduation could also be managed under the State Examination Center (SEC). This could help improve HC quality. Additionally, gradually increasing the military conscription age to 20 would expand access to higher education for individuals aged 18–20.

Expected Outcome: Education quality will improve, students will acquire more practical skills, and access to higher education will expand.

Recommendation 7. The level of state regulation in the education system should be structured according to the degree of liberalism–dirigisme based on educational levels.

Justification: All levels of education play a critical role in the development of KE. Preschool and general education should be under strong state control since these levels are compulsory and form the foundation of quality and accessibility for all children. In contrast, higher and vocational education should be more liberal. While reducing state intervention in the governance of higher education, oversight of the quality of graduates and their alignment with labor market needs should be strengthened.

Expected Outcome: Educational accessibility will improve, and the quality of human capital will increase.

Recommendation 8. It is advisable to implement a regional approach in university admissions.

Justification: A regional approach would involve increasing the number of universities in the regions and promoting admission and education at regional universities. This would stimulate regional development and contribute to improving education quality across the country.

Expected Outcome: Regional development will accelerate, and the social burden on Baku will be reduced.

Recommendation 9. Information accessibility must be ensured, and ICT infrastructure must be further developed.

Justification: For knowledge development, the creation of e-libraries, open platforms for access to scientific sources, the translation of

Nobel laureates' and highly cited works into Azerbaijani, and the development of high-quality digital content are essential.

Expected Outcome: Access to modern scientific resources will improve, and quality indicators in academic output will increase.

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The defense of the dissertation will be held on May 7, 2025, at 11:^{00} a.m. at the meeting of the Dissertation Council ED 1.10, operating under the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan.

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The dissertation is available for review at the library of the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan.

The electronic versions of the dissertation and the abstract have been published on the official website of the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan.

https://economics.org.az

The abstract was sent to the relevant addresses on April 7, 2025.

Signed for print: on 04.04.2025.
Paper format: A5
Volume: 75282
Number of hard copies: 30