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INTEGRATED DIAGNOSTIC ASSESSMENT OF LIGHT INDUSTRY CLUSTERS DEVELOPMENT IN THE SOCIO-ECONOMIC SYSTEM OF AZERBAIJAN

The object of research is the processes of formation and development of light industry clusters in the socio-economic system of Azerbaijan, as well as the mechanisms of their technological audit and assessment of production reserves in the conditions of innovative transformation of the economy. The research problematic lies in the lack of comprehensive diagnostic tools for assessing the integration potential of industrial zones and identifying hidden production reserves. Existing fragmented approaches do not allow for an accurate measurement of the impact of networking on labor productivity indicators, which complicates informed management decisions regarding the allocation of public investment in infrastructure.

The results include a developed diagnostic model for assessing industrial cluster potential based on the Integral Diagnostic Index (IDI). Calculations revealed the highest value for the Baku-Absheron region (0.74). The Aran (0.54) and Lankaran-Astara (0.46) regions, however, have limited potential. The research quantified a stable investment multiplier – 1.61, demonstrating the effectiveness of cluster infrastructure development. It was also found that cluster integration provides a 22% increase in labor productivity compared to stand-alone enterprises.

The results are mainly explained by the synergistic effect of concentrating resources in technology parks, including the Mingachevir Technology Park, and lowering transaction costs. The Baku-Absheron region's leadership is based on its well-developed innovation infrastructure. The higher efficiency of clusters is due to optimizing supply chains (reducing logistics time by 45%) and the dominant influence of human capital: the share of qualified personnel in leading clusters reaches 72%.

The results can be utilized in practice if they are incorporated into government monitoring programs for industrial policy until 2030. The developed IDI model is applicable to assessing the effectiveness of existing industrial districts and identifying regions requiring priority financial support for non-oil sector development.

Keywords: innovation, economic potential, industrial clusters, light industry, non-oil sector, competitiveness.

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1. Introduction

The theoretical foundations of the cluster approach were established in a research where clusters identified as a critical tool for competition in the modern economy [1]. In [2] substantiated the influence of geographic location in shaping competitiveness on economic development. Research further advanced the understanding of the micro-economic foundations of competitiveness at the firm level [3]. In addition, they identified the key determinants of the success of national economies [4]. However, these fundamental works did not take into account the specifics of the transition economies of the Caspian region.

The critical importance of logistical capacity for regional development is highlighted in the research [5]. Another research considers the impact of digitalization and e-commerce on modern market governance mechanisms [6]. The spatial dimension and geography of innovation processes were explored in detail in work [7]. Publication [8] demonstrated a consistent connection between clusters and economic convergence of regions. The microfoundations of urban agglomera-

tions and their role in the formation of industrial nodes are described in the research [9]. Research [10] focuses on social networks within cluster complexes. Modern trends in international competitiveness are analyzed in work [11]. Research [12] emphasizes the role of localized learning in strengthening industrial competitiveness. Publication [13] views clusters as a new growth vector for the European space. Despite the depth of these researches, they lack a methodology for an integrated diagnostic assessment specifically for the light industry of Azerbaijan.

Technology parks as elements of innovation infrastructure are analyzed in a number of recent researches. The current state of technology park as elements of innovation infrastructure is critically assessed in work [14]. In addition, research [15] determine the key criteria for success in the management of university technology parks. Work [16] proposes marketing strategies for effectively managing the information environment of such structures. The theory of knowledge spillovers in the research [17] explains the mechanisms of the spatial distribution of innovations. The concept presented in [18] complements the understanding of internal cluster dynamics through the “local buzz” theory.

Publication [19] notes the importance of urban specialization in stimulating scientific activity. These views are in harmony with the classical theories of geography and trade in paper [20]. However, these authors do not consider the mechanisms for creating production reserves in textile clusters.

In the context of global value chains, the World Bank notes the importance of integration for developing economies [21]. Research [22] links urbanization processes to overall economic growth. Report [23] emphasizes the inevitability of the transition to Industry 4.0 technologies. The European Commission's reports emphasize smart specialization strategies as a basis for regional sustainability [24]. The OECD emphasizes adaptive industrial policies in its recommendations [25]. UNIDO highlights new models of industrial development to ensure global competitiveness [26]. However, these international reports are general in nature and do not offer specific econometric models for assessing Azerbaijani enterprises.

The social aspects of government regulation and their impact on growth are discussed in the research [27]. The transformation of global capitalism through the prism of value chains is analyzed in [28]. Work [29] proposes ways to improve the foreign economic relations of Azerbaijan's textile industry. Research [30] is dedicated to the development of light industry within the framework of the "green" economy. Publication [31] points to the necessity of adaptive industrial policy in the 21st century. Environmental aspects of economic development are studied in work [32]. Finally, research [33] emphasizes the importance of information interaction between the university and society in technology park systems.

Despite the presence of extensive literature, the issues of comprehensive diagnostics of technological audit and identification of hidden production reserves of the light industry of Azerbaijan remain poorly studied. In particular, there are no models linking the diagnostic assessment index (IDI) with specific performance indicators of textile enterprises in the Aran and Ganja-Dashkesan regions.

The object of research is the processes of formation and development of light industry clusters in the socio-economic system of Azerbaijan, as well as the mechanisms of their technological audit and assessment of production reserves in the conditions of innovative transformation of the economy.

The aim of research is to integrate diagnostic assessment of light industry clusters development in the socio-economic system of Azerbaijan. This will make it possible to justify specific steps to update industrial policy that will help make regions more competitive and ensure stable economic growth.

To achieve this aim, the following objectives were set:

1. To analyze in which economic regions of Azerbaijan today production is most concentrated and how things are going with the formation of clusters, based on recent statistical data and comparative methods.

2. To identify what exactly hinders or helps the development of such associations. The research pays special attention to three aspects:

- the level of innovation and the availability of qualified personnel locally;
- how enterprises cooperate with each other and integrate into common production chains;
- the role of regional specialization and the quality of government support.

3. To formulate and prove the effectiveness of recommendations for a new industrial policy. These measures should help create viable ecosystems and increase the share of non-oil exports.

2. Materials and Methods

The article examines the development of the light industry of Azerbaijan. At the regional level, such industries as textile, clothing,

leather and silk are considered. The choice of these areas is due to their significant role in the structure of industrial production of this country. Key economic regions are covered Baku-Absheron, Aran, Ganja-Dashkesan, Sheki-Zagatala and Lankaran-Astara, which differ markedly in the level of industrial development and organization of production.

For the cluster development level, an integrated approach was used, combining several analysis methods. In particular, statistical and comparative methods are used, which made it possible to process data from the State Statistics Committee of the Republic of Azerbaijan for the period 2018–2024. Particular attention is paid to indicators such as industrial production, employment and economic activity. Since they most fully reflect the state of the industry at the regional level.

An integrated approach was used to assess the development of light industrial clusters, which is based on a combination of several analysis methods. Static and comparative methods made it possible to process official data from the State Statistics Committee of the Republic of Azerbaijan for the period 2018–2024. The main attention was paid to such indicators as the volume of industrial production and the level of investment activity of the regions.

The evaluation of cluster products is based on several key analytical processes. First of all, the cluster identification method was tried out, including the calculation of coefficients (LQ) and the Gini index [17–20]. This made it possible to determine the degree and specialization of light industry in individual regions. In addition, econometric modeling was used to analyze the relationship between the level of infrastructure development. Structural-functional analysis played an important role. This made it possible to assess the conditions and level of interaction between enterprises within production systems.

For a more accurate understanding of these processes, a structural-functional approach was additionally applied, with the help of which it was possible to more accurately analyze situations between enterprises and the characteristics of the organizational environment. Data processing and statistical calculations were performed using Microsoft Excel, which made it possible to conduct regression analysis and clearly identify regional differences.

The empirical basis of research was made up of secondary indicators obtained from official sources. To improve the qualification of the results, the integral diagnostic index (IDI) was sufficiently used, which makes it possible to combine heterogeneous indicators into a single system.

To assess the level of development of clusters in the regions, a diagnostic model was developed, which has three groups of indicators: production and economic, infrastructure and operational, as well as indicators of human and innovative potential. Each of these groups reflects a separate side of cluster development, and their combined use provides a more holistic picture of the state of the regional industry.

Groups of indicators reflect comprehensive cluster development and make it possible to generally assess the industrial potential of the country's regions.

Using formula, the integral diagnostic index of cluster development was calculated

$$IDI = \sum(w_i \cdot I_i), \quad (1)$$

where IDI – integral diagnostic index of cluster development; w_i – weight coefficient of the indicator; I_i – standardized value of the indicator.

The coefficients (w_i) were determined using an expert assessment using the Delphi method with the participation of 10 specialists from the Ministry of Economics and academic researches. The final results gave the following coefficient value: 0.30 – for economic and production indicators, 0.25 – for infrastructure, 0.25 – for human resources and 0.20 – for innovative potential.

Such a distribution determines the significant role of production potential and personnel retraining for the purpose of developing the light industry of the Azerbaijan Republic at the present stage. At the initial stage, the groups of indicators were equalized (0.25 each). And then the authors decided to adjust them taking into account the impact on production volume in different regions. To compare indicators with different units of measurement, the min-max normalization method was used. For example, innovation indicators are expressed as percentages, and investments – in manats. The result showed a range from 0 to 1. This made it possible to combine indicators within the integral index more correctly.

The integral calculation revealed differences in the levels of cluster development of regions, and also classified the levels of cluster potential.

The analysis showed a significant development in the levels of development of clusters by region. The highest rate was in the Baku-Absheron region – 0.74, this is mainly due to the innovative potential of industrial infrastructure. The Lankaran-Astara region had a lower index value – 0.46. the distinctive feature of the region indicates the presence of structural limitations.

Diagnostic indices of the regions are given in Table 1.

Table 1

Diagnostics of development indicators of various light industry clusters in the regions of Azerbaijan

Region	Indicators				
	Production-economic	Infrastructure development	Innovation capacity	Human resources	Integral index
Baku-Absheron	0.78	0.75	0.70	0.72	0.74
Aran	0.56	0.52	0.48	0.58	0.54
Ganja-Dashkasan	0.58	0.55	0.50	0.60	0.56
Sheki-Zagatala	0.60	0.57	0.52	0.59	0.57
Lankaran-Astara	0.49	0.45	0.42	0.48	0.46

The quantitative results of Table 1 confirmed the difference in the level of infrastructural development, innovation potential and human capital. These indicators are of significant importance in the formation of regional light industry clusters in Azerbaijan.

The assessment of the relationship between different levels of cluster development and the results of regional economic development was solved by using an econometric model. The mathematical model revealed the way various factors influence the productivity and volume of industrial production of the light industry.

The general form of the econometric model is expressed as follows

$$Y = \alpha + \beta_1 INF + \beta_2 INN + \beta_3 HR + \beta_4 PROD + \varepsilon, \quad (2)$$

where Y – regional industrial productivity indicator; INF – infrastructure development index; INN – innovation capacity indicator; HR – human resources indicator; $PROD$ – production-economic indicator; ε – random error term.

The application of the econometric model allows for identifying the key factors influencing cluster development and provides empirical evidence supporting the effectiveness of cluster-based industrial policies.

3. Results and Discussion

3.1. Analysis of production concentration and cluster formation in the economic regions of Azerbaijan

The analysis covers the development of light industry clusters in the economic regions of Azerbaijan. The analysis was carried out on the basis of an applied diagnostic index, which combines production and economic indicators, infrastructure provision parameters, the level of innovation and characteristics of human capital. Thus, a fragmentary assessment

of the degree of clustering of regional industries was transformed into a systematic analysis using complex indicators [21]. The result revealed heterogeneity in the level of development of clusters with significant differences (Fig. 1). The highest figure was recorded in the Baku-Absheron economic region – 0.74. The region's dominant position is due to the country's best transport, logistics and innovation infrastructure, as well as a skilled workforce that supports technological innovation.

In contrast, the economic regions of Aran (0.54) and Lankaran-Astara (0.46) are characterized by more limited dynamics of cluster development. Low investment activity and involvement in innovative processes, as well as limited infrastructure, have become a barrier to the effective implementation of light industry enterprises in regional clusters [22].

The economic regions of Ganja-Dashkasan and Sheki-Zagatala occupy average positions (0.57 each). On the one hand, these regions have a strong influence on textile production and crafts, which forms the basis of cluster interaction. On the other hand, continuing restrictions associated with technological backwardness and insufficient development of innovation support institutions prevent the full realization of their existing industrial potential. The research results show that the main factor determining regional differentiation in terms of cluster development is the level of industrial specialization. However, innovation infrastructure also significantly influences this factor. Thus, differences in access to these resources determine the basis for the formation of sustainable and competitive light industry clusters in Azerbaijan.

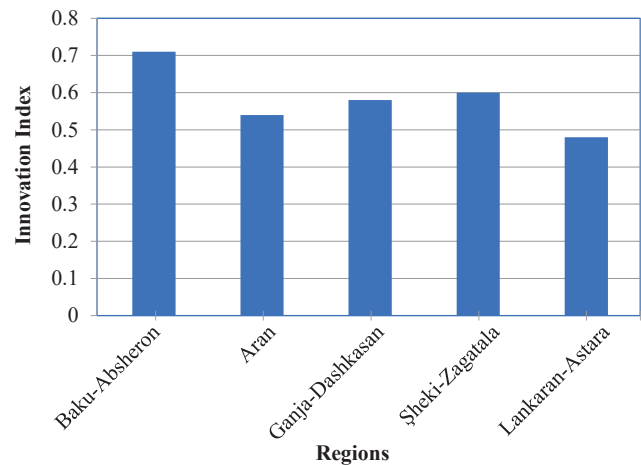


Fig. 1. Results of the diagnostic assessment of the development of Light Industry Clusters

The integral diagnostic index graphically illustrates the comparative level of development of clusters by region. The research results showed that the Baku-Absheron region is far superior to other economic regions in terms of cluster development potential. The levels of development of clusters in a graphical distribution have proven that technological infrastructure, available human capital and industrial concentration are mutually correlated. The result is high cluster performance. In addition, researches have shown that stronger cluster formation is observed in regions with more developed industrial ecosystems and high productivity.

The analysis established that the creation of industrial parks such as the Mingachevir Industrial Park is a catalyst for the formation of full-fledged cluster structures. The outcome of the assessment can be reflected in three key stages of transformation:

1. Institutionalization, i. e. integration of isolated enterprises to network interaction.
2. Integration of resources or optimization of cotton and cocoon supply chains within the country.
3. Digitalization, i. e. implementation of production management systems to increase the flexibility of small and medium-sized enterprises (SMEs).

3.2. Econometric analysis of cluster development factors

3.2.1. Capital intensity and investment attractiveness

The research of the relationship between the development of clusters and the industrial efficiency of regions was merged into an econometric model. At the beginning of the research, the influence of infrastructure, innovation potential, human capital, production and economic factors on the results of industrial production was assessed.

The results of the analysis proved that the development of light industry clusters in Azerbaijan is fundamentally determined by the volume of investments in fixed capital and the efficiency of their use. The formation of clusters also helps to increase the investment attractiveness of regions, reducing both barriers to entry and risks for private investors. This relationship was then quantified. For this purpose, a linear regression model was built based on data for the key industrial regions of the country – Baku-Absheron, Aran, Ganja-Dashkasan, Sheki-Zagatala and Lankaran-Astara. The formula represents the general view of the model

$$Z = \beta_0 + \beta_1 X + \varepsilon, \tag{3}$$

where Z – volume of industrial output in the light industry sector (mln AZN); X – fixed capital investments (mln AZN); β_0 – constant term representing baseline production without incremental investment; β_1 – regression coefficient (investment multiplier); ε – random error term.

The regression equation $Z = 1.61X - 2.15$. The negative constant term ($\beta_0 = -2.15$) indicates that the model is valid only for investment volumes exceeding 1.34 mln AZN (the break-even point where $Z > 0$). This mathematically reflects high entry barriers and fixed operational costs: a critical threshold of investment is required before any positive industrial output can be generated in the light industry sector. Based on the modeling results, it can be judged that there is a positive and stable relationship between production volume and investment. At the same time, a negative value of the free term indicates the existence of a certain investment threshold. At this threshold, production becomes economically feasible. This factor indicates the presence of relatively high barriers to entry into the industry and significant initial costs.

The data in Table 2 characterizes the development of the industry during the period of active cluster formation (2018–2024).

Investment and production indicators in Azerbaijan’s light industry (by region)

Economic region/ Cluster node	Investment in fixed assets (X), mln AZN	Industrial output (Z), mln AZN	Capital intensity ratio, X/Z
Baku-Absheron	115.4	183.6	0.628
Aran	70.5	111.4	0.632
Ganja-Dashkasan	41.5	64.7	0.641
Sheki-Zagatala	18.2	27.2	0.669
Lankaran-Astara	24.5	37.3	0.657
Mingachevir (industrial park)	52.0	92.8	0.560

Note: calculated by authors based on State Statistical Committee of Azerbaijan data

The high value of the coefficient ($R^2 = 0.985$) of determination is explained by the concentration of investment in light industry, such as industrial parks, in organized structures. The Mingachevir Industrial Park is a vivid example of this. And in such conditions, investments in production capacity are transformed faster. The calculated regression equation is

$$Z = 1.61X - 2.15.$$

The coefficient $\beta_1 = 1.61$ indicates that for every 1 mln AZN invested in the light industry sector, a regional output increase of 1.61 mln AZN is expected.

Regression analysis (Fig. 2) indicates that both infrastructure and human capital have a significant impact on industrial productivity, and therefore on the development of clusters. Innovative potential has a significant statistical impact (Table 3). This factor highlights the importance of both knowledge dissemination and technological upgrading.

The regression results confirm that improvements in industrial infrastructure and human capital significantly contribute to the development of regional clusters and enhance industrial productivity.

Main conclusion: the key conditions for the growth of regional light industry clusters in Azerbaijan are improving the skills of the workforce and developing infrastructure.

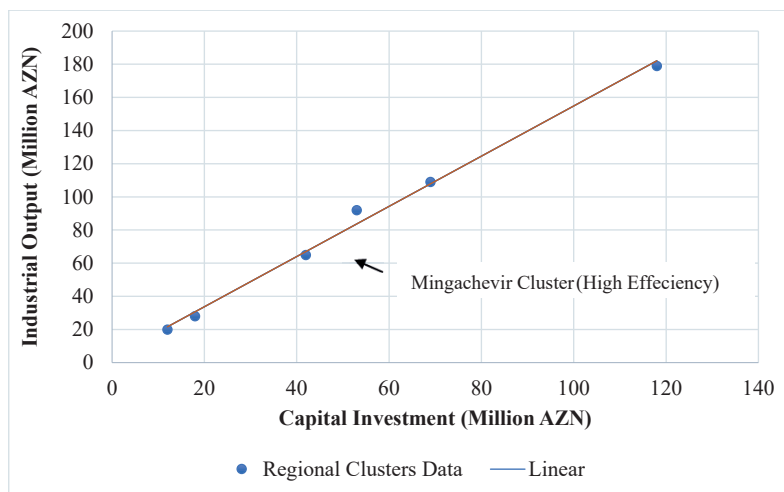


Fig. 2. Regression Plot: correlation between investment and industrial output

Table 2

Econometric regression results

Table 3

Variable	Coefficient	Significance
Infrastructure	0.42	Significant
Innovation	0.31	Significant
Human resources	0.38	Significant
Production indicators	0.27	Moderate

As can be seen from the regression analysis shown in Table 3, there is a clear relationship (0.42) between the development of infrastructure and production efficiency. Thus, the conclusion can be made about the key role of physical proximity to logistics nodes in stimulating cluster creation. Nevertheless, the very significant β -coefficients for the investment threshold imply the existence of a rather large amount of financial obstacles for SMEs. From an empirical point of view, one may conclude that the spontaneous creation of light industry clusters in economically peripheral regions will not occur due to the lack of state subsidies.

3.2.2. Labor productivity factors and human capital

The gradual shift from labor-intensive production to more knowledge-intensive forms of activity determines the transition to a cluster model in light industry. The research found that regions with a higher share of skilled workers demonstrate higher labor productivity. The dominant role here belongs to the Baku-Absheron region and the Mingachevir Industrial Park, where there is a high concentration of specialists.

The assessment of the impact of human capital was carried out using a production function of the Cobb-Douglas type, focused on the indicator of Labor Productivity (*LP*)

$$LP = A \cdot K^\alpha \cdot H^\beta,$$

where *LP* – labor productivity (output per worker); *H* – human capital index (proxied by the ration of employees with specialized vocational or higher education); β – elasticity of productivity with respect to human capital.

The data in Table 4 shows that in cluster structures there is higher labor efficiency. An increase in the share of skilled workers is accompanied by increased productivity and more efficient use of resources.

Table 4

Human capital metrics and labor productivity (2023–2024)

Cluster/Region	Number of employees (<i>L</i>)	% of skilled workforce (<i>H</i>)	Output per worker (<i>LP</i>), AZN/person
Baku-Absheron	8400	72	21857
Aran	7800	44	14282
Ganja-Dashkasan	4500	54	14378
Sheki-Zagatala	1800	48	15111
Lankaran-Astara	2100	42	17762
Mingachevir (industrial park)	3200	68	29000

Note: authors estimation based on regional employment data

The important feature of the econometric model is the detected institutional and structural obstacles. The negative constant term in the estimated model ($\beta_0 = -2.15$) theoretically explains the existence of “entry barriers” within the light industry branch in Azerbaijan. The reasons for these entry barriers can be attributed to the capital-intensive nature of the industry and insufficient specialized training institutions in areas such as Aran and Ganja-Dashkasan. As a result, the absence of synergies between human resources emerges as the key factor that impedes the shift from merely concentrated manufacturing activities to an innovational cluster.

Thus, the lack of vocational training centers in the Aran region acts as a primary institutional barrier to achieving the cluster efficiency observed in the Baku-Absheron zone.

3.2.3. Infrastructure and logistics factors

Infrastructure in general, and in particular transport and logistics infrastructure, is an important factor in the development of clusters. Azerbaijan is a country with a Middle Corridor (Trans-Caspian International Transport Route), which is not just a transport route, but rather a concept that forms a multimodal connectivity system [23–25]. The efficiency of light industry mainly depends on proximity to key transport routes, including the Middle Corridor.

There are significant advantages to locating businesses close to major logistics hubs (Table 5).

For example, these are light industry enterprises in Baku, Alyat, and Ganja. As a result, to locating businesses close to major logistics hubs transportation costs are reduced, delivery times for raw materials and finished products are reduced.

Table 5

Impact of logistical proximity on cluster competitiveness

Infrastructure factor	Cluster-based	Non-cluster	Variance
Logistics costs (% of revenue)	8.5%	14.2%	–5.7%
Supply chain lead time (days)	12	22	–45%
Shared warehouse utilization	88%	45%	+43%

Comparing cluster and non-cluster models leads to the following results:

- delivery times are reduced;
- logistics costs are reduced;
- warehouse infrastructure is used more efficiently.

In general, research can draw the following conclusion: logistics connectivity and developed infrastructure play an important role in increasing the competitiveness of enterprises and the sustainable development of clusters.

3.3. Formulation and justification of the effectiveness of the new industrial policy recommendations

The research showed a direct relationship between productivity indicators and the development of regional clusters in the country’s light industry. Regions with a high cluster index demonstrated higher productivity results and a more developed innovative environment. The development of clusters creates additional advantages for companies. These advantages contribute to increased production efficiency and strengthened position in the domestic and international markets.

Fig. 3 and 4 demonstrate that there is a positive correlation between the level of cluster development and production performance. Analysis of the graph shows that more developed regions demonstrate higher productivity. It also shows that cluster industrial policy can significantly improve economic performance in the light industry sector.

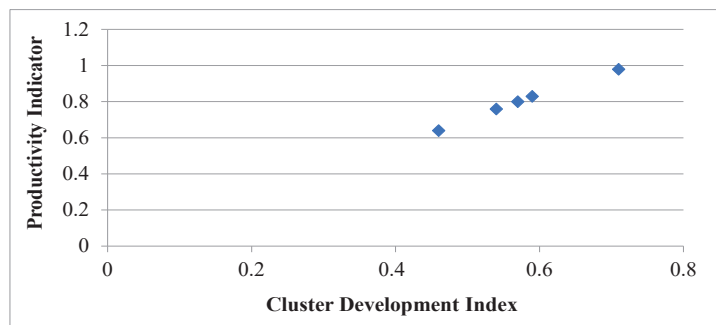


Fig. 3. Impact of cluster development on industrial productivity

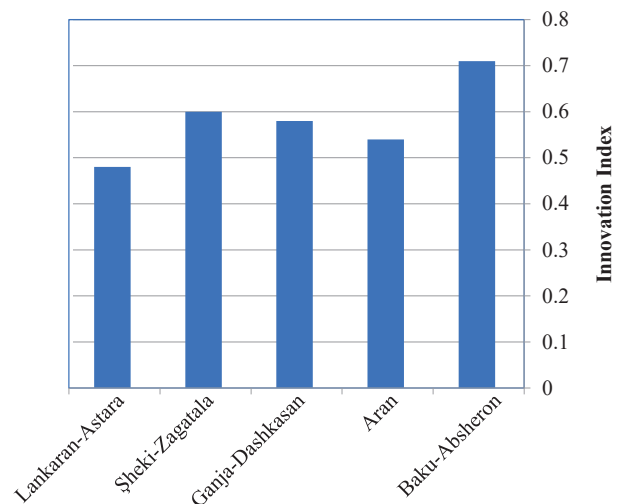


Fig. 4. Regional distribution of the light industry innovation index

At the same time, the distribution of clusters across regions remains uneven. The Baku-Absheron region remains a more developed central cluster zone. And the regions of Aran and Lankaran-Astara need additional support and remain on the list of developing clusters.

Innovative potential indicators (Fig. 4) demonstrate the level of technological readiness of the regions. In this regard, the Baku-Absheron region remains a leader in the implementation of modern production solutions [26, 27].

3.4. Discussion

Research has shown that the development of light industry clusters in Azerbaijan is uneven. And this mainly depends on the concentration of resources. The dominant position of the Baku-Absheron region (0.74), high labor productivity in the Mingachevir Industrial Park is mainly explained by the concentration effect. At the same time, infrastructure, investment and qualified personnel are concentrated within one industrial environment. According to Table 2, the capital intensity indicator in Mingachevir (0.56) is lower than the average level for other regions (around 0.635). consequently, a developed and integrated infrastructure at relatively lower costs makes it possible to achieve higher production volumes. It should be noted that the Aran region includes both traditional enterprises and the Mingachevir Industrial Park. This fact determines the advantages of a cluster organization.

Fig. 2 confirms the close relationship between the level of cluster development and investment attractiveness. This concept allows to consider clusters as a mechanism that increases the efficiency of investments. And this in turn contributes to the economic growth of the regions. A negative intercept in the regression model indicates the presence of high barriers to entry. At the same time, to start effective production means the need to achieve a certain level of investment.

The research showed that the Aran and Lankaran-Astara regions had lower rates. The reason is limitations in the development of human capital. According to Table 4, even in the presence of a raw material base, a smaller share of skilled workers is directly related to lower productivity.

The findings highlight the importance of small and medium-sized enterprises interacting in contrast to traditional models that focus on large, isolated enterprises. In this regard, resource integration and digitalization play an important role. Practice shows that government initiatives, such as the creation of industrial parks, significantly accelerate the formation of clusters [1, 2]. The observed 22% productivity surplus in clusters exceeds typical growth rates in non-integrated regional industries [28, 29].

The research results may be useful for various groups and from a practical point of view. In particular:

- for government agencies: in terms of identifying regions (Fig. 1) that require additional support;
- for investors: as a guideline when assessing the effectiveness of investments (Table 1);
- for educational institutions: as a justification for the need to develop professional training.

The research also has certain limitations. It is based on data from 2018–2024 and does not fully reflect long-term effects. The main attention is paid to economic indicators. Unfortunately, significant social and environmental aspects were not included in the model [30].

The results obtained also emphasize the importance of developing foreign economic relations of Azerbaijan in the textile industry [31, 32]. The development of export-oriented production chains and strengthening the interaction between science and industry can improve the competitiveness of the industry [30]. Such institutional interaction acts as a catalyst for the concentration effect observed in our research, providing a structured framework for the digital and technological transformation of the non-oil sector [13, 33].

It is also necessary to take into account external factors. Geopolitical changes in the region and the restoration of economic activity in the liberated territories have impacted logistics and supply chains. In modern conditions, the development of transport corridors, such as the Middle Corridor, is of particular importance.

Future research can be expanded by considering the principles of the Green Economy and analyzing new industrial zones, which will allow for a more complete assessment of the transformation of the industrial system of the Republic of Azerbaijan.

4. Conclusions

1. A comparative analysis of the cluster potential of various economic regions of Azerbaijan was conducted based on the latest statistical data. The research results include the calculated Integrated Diagnostic Index (*IDI*) and the developed diagnostic model. These indicators were significantly improved due to the high degree of clustering. Revealed high spatial heterogeneity. The highest value of cluster concentration was identified for the Baku-Absheron region (0.74). The Aran (0.54) and Lankaran-Astara (0.46) regions demonstrate limited capabilities. Scientific originality lies in the transition from fragmented monitoring to a comprehensive diagnostic index, which allows for the first time to quantify the gap between regions. Expected success: depending on the current potential of a particular regional cluster, the result allows the government to provide differentiated support.

2. The research identified and quantifies the factors hindering or facilitating the development of cluster connections along these three dimensions. The research results showed that the predominant factor is human capital: high labor productivity in leading regions is ensured by a 72% share of qualified personnel. In contrast, cooperation in other regions is hampered by unstable supply chains and lack of local specialization. Stable investment multiplier – 1.61. Scientific originality lies in the mathematically substantiated fact that network interaction in technology parks reduces the capital intensity ratio to 0.56. Possible success: the identified models in practice reduce investment risks by avoiding areas with high structural barriers.

3. A series of recommendations for Azerbaijan's new industrial policy until 2030 were developed and clarified. The research findings provide a mechanism to overcome talent shortages and improve digital coordination among enterprises to stimulate non-commodity exports. Scientific originality lies in the rationale for clustering as a means of creating viable ecosystems, rather than just isolated production sites. Possible success: the results achieved in public policy will accelerate the diversification of the non-resource sector and provide universities with a solid basis for changing their curricula in accordance with the needs of the economy.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

Financing

The research was performed without financial support.

Data availability

Manuscript has no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies in creating the presented research.

Authors' contributions

Metanet Ahmadova: Conceptualization, Methodology, Supervision; **Minura Karimova:** Formal analysis, Investigation, Software; **Fazil Kerimov:** Resources, Data curation, Project administration; **Rizvan Majidov:** Data curation, Writing – review and editing, Visualization; **Gulgun Abdiyeva:** Formal analysis, Investigation, Methodology; **Lamiye Bayramova:** Investigation, Writing – original draft, Validation; **Samira Nuriyeva:** Formal analysis, Software, Validation.

References

- Porter, M. E. (1998). Clusters and the new economics of competition. *Harvard Business Review*, 76 (6), 77–90. <https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition>
- Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, 14 (1), 15–34. <https://doi.org/10.1177/089124240001400105>
- Porter, M. E., Ketels, C., Delgado, M. (2011). Microeconomic foundations of competitiveness. *World Economic Forum Report*.
- Delgado, M., Ketels, C., Porter, M. E., Stern, S. (2019). The determinants of national competitiveness. *NBER Working Paper No. 18249*. <https://doi.org/10.3386/w18249>
- Amrahov, V. T. O., Karimova, M. H. G., Karimov, F. J. (2022). Development opportunities of material and technical resource potential in the agricultural sector. *European Journal of Economics and Management Sciences*, 1, 62–68. <https://doi.org/10.29013/ejems-22-1-62-68>
- Karimova, M. H., Babakishiyeva, S. F., Metiyeva, S. (2023). The impact of e-commerce development in Azerbaijan on consumer food market management. *European Scientific Review*, 5 (6), 25–28.
- Asheim, B. T., Gertler, M. S.; Fagerberg, J., Mowery, D., Nelson, R. (Eds.) (2009). The Geography of Innovation: Regional Innovation Systems. *The Oxford Handbook of Innovation*. Oxford University Press, 291–317. <https://doi.org/10.1093/oxfordhb/9780199286805.003.0011>
- Delgado, M., Porter, M. E., Stern, S. (2014). Clusters, convergence, and economic performance. *Research Policy*, 43 (10), 1785–1799. <https://doi.org/10.1016/j.respol.2014.05.007>
- Duranton, G., Puga, D. (2004). Micro-foundations of urban agglomeration economies. *Handbook of Regional and Urban Economics*. Elsevier, 2063–2117. [https://doi.org/10.1016/s1574-0080\(04\)80005-1](https://doi.org/10.1016/s1574-0080(04)80005-1)
- Gordon, I. R., McCann, P. (2000). Industrial Clusters: Complexes, Agglomeration and/or Social Networks? *Urban Studies*, 37 (3), 513–532. <https://doi.org/10.1080/0042098002096>
- Ketels, C. (2013). Recent research on competitiveness and clusters: what are the implications for regional policy? *Cambridge Journal of Regions, Economy and Society*, 6 (2), 269–284. <https://doi.org/10.1093/cjres/rst008>
- Maskell, P., Malmberg, A. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics*, 23 (2), 167–185. <https://doi.org/10.1093/cje/23.2.167>
- Ketels, C., Protsiv, S. (2013). Clusters and the new growth path for Europe. *Europe Working Paper Series*, No. 14. Available at: <https://www.hbs.edu/faculty/Pages/item.aspx?num=45185>
- Trillo, J. R., Mammadov, J., Huseynov, Y., Ahmadova, M., Eminova, A. (2026). Automation of the Control Process of the Research and Flexible Production Areas of the Technopark. *Ai*, 7 (5), 173. <https://doi.org/10.3390/ai7050173>
- Mammadov, J., Huseynov, E., Talibov, N., Akhmadova, T., Ganjalijeva, G. (2018). Development of Program Tool For Expert Assessment of Innovation Projects in the Scientific Technopark. *IFAC-PapersOnLine*, 51 (30), 571–574. <https://doi.org/10.1016/j.ifacol.2018.11.248>
- Mammadov, J., Huseynov, Y., Ahmadova, M., Mammadova, G., Askerov, A. (2025). Developing a marketing strategy for efficient management of the information environment of the technology park. *Eastern-European Journal of Enterprise Technologies*, 3 (13 (135)), 26–34. <https://doi.org/10.15587/1729-4061.2025.330483>
- Audretsch, D. B., Feldman, M. P. (2004). Knowledge spillovers and the geography of innovation. *Handbook of Regional and Urban Economics*. Elsevier, 2713–2739. [https://doi.org/10.1016/s1574-0080\(04\)80018-x](https://doi.org/10.1016/s1574-0080(04)80018-x)
- Bathelt, H., Malmberg, A., Maskell, P. (2004). Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28 (1), 31–56. <https://doi.org/10.1191/0309132504ph4690a>
- Feldman, M. P., Audretsch, D. B. (1999). Innovation in cities: Science-based diversity, specialization and localized competition. *European Economic Review*, 43 (2), 409–429. [https://doi.org/10.1016/s0014-2921\(98\)00047-6](https://doi.org/10.1016/s0014-2921(98)00047-6)
- Krugman, P. (1991). *Geography and trade*. MIT Press.
- World Development Report 2020: Trading for Development in the Age of Global Value Chains (2019). Washington: World Bank. <https://doi.org/10.1596/978-1-4648-1457-0>
- Turok, I., McGranahan, G. (2019). Urbanisation and Economic Growth: The Arguments and Evidence for Africa and Asia. *Urbanisation*, 4 (2), 109–125. <https://doi.org/10.1177/2455747119890450>
- The future of manufacturing: Industry 4.0 and global production networks (2021). McKinsey Global Institute.
- Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery (2021). European Commission. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0350>
- Centre for Entrepreneurship, SMEs, Regions and Cities. OECD. Available at: <https://www.oecd.org/cfe/regionaldevelopment/oecd-reviews-of-regional-innovation.htm>
- The Future of Industrialization in a Post-Pandemic World: Industrial Development Report 2022 (2022). Vienna: United Nations Industrial Development Organization. Available at: <https://www.unido.org/news/future-industrialization-post-pandemic-world-industrial-development-report-2022>
- Karimov, V., Karimova, S. (2018). The results of implementation of the leslie model taking into account various epidemics. *Internauka*, 15. <https://doi.org/10.25313/2520-2057-2018-15-4115>
- Gereffi, G. (2018). *Global value chains and development: Redefining the contours of 21st century capitalism*. Cambridge University Press. <https://doi.org/10.1017/9781108559423>
- Ismayilov, K. (2025). *Textile Industry in Azerbaijan: Opportunities, Perspectives and Challenges*. Center for Economic and Social Development (CESD). Available at: <http://cesd.az/y/panel/uploads/46174627589-CESDPaperTextileindustryinAzerbaijan.pdf>
- "Greening the Industry" – Azerbaijani textile manufacturers Alyans, Baku, and BETEX benefit from taking part in the EU4Environment company assessments (2023). EU4Environment. Available at: <https://www.eu4environment.org/news/greening-the-industry-azerbaijani-textile-manufacturers-alyans-baku-and-betex-benefit-from-taking-part-in-the-eu4environment-company-assessments/>
- Rodrik, D. (2004). Industrial policy for the twenty-first century. *HKS Working Paper No. RWP04-047*. Available at: <https://www.hks.harvard.edu/publications/industrial-policy-twenty-first-century>
- Hasanov, R. I., Mehdiyeva, G., Bahramov, A., Cavadzada, X., Kerimova, M. (2024). Examining Sectoral Contributions and Determinants of Carbon Emission Reduction in Azerbaijan: An Empirical Analysis. *International Journal of Sustainable Development and Planning*, 19 (8), 2873–2879. <https://doi.org/10.18280/ijstdp.190806>
- Orujova, G., Agayev, U., Genjeliyeva, G., Ahmadzada, A., Huseynov, Y., Ahmadova, M. (2025). Modeling of the innovation construction mobile industrial robot applied in technology park. *2025 International Conference Automatics and Informatics (ICAI)*. Varna 75–79. <https://doi.org/10.1109/icai67591.2025.11324555>

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