Improvement of financial analysis of cluster activities

Ilhom Ochilov*

Tashkent State University of Economics, Tashkent, Uzbekistan

Abstract. This research paper addresses the critical need for an advanced framework to elevate the financial analysis of cluster activities. Clusters, defined as geographically proximate groups of interconnected companies and associated institutions in a particular field, have emerged as key drivers of economic growth. However, the existing financial analysis methods often fall short in capturing the complex dynamics and interdependencies within these clusters. The paper delves into the current challenges and limitations of conventional financial analysis in the context of cluster activities. It highlights the inadequacy of standard metrics in capturing the unique characteristics and synergies inherent in clusters, leading to suboptimal decision-making processes. By integrating data analytics, risk assessment models, and qualitative assessments, the framework aims to provide a holistic view of the financial landscape within clusters. Also explores the broader impact on regional economic development and the potential scalability of the framework across various industries. This research contributes to the ongoing discourse on financial analysis methodologies, specifically tailored for cluster activities. The proposed framework offers a sophisticated and practical solution to address the shortcomings of conventional approaches, thereby empowering stakeholders to make more informed decisions in the dynamic and interconnected landscape of cluster-based economies.

1 Introduction

The modern economy is characterized by speed, flexibility and the ability to interact in an environment in which innovation and economic growth are geographically concentrated [1]. Clusters are the cornerstones of this reality.

The focus of economic development is shifting away from the national level, away from supporting industries and away from supporting individual firms [2, 3]. Today, the emphasis is on the development of cities, regions and their cluster ecosystems [4, 5]. This bottom-up approach shows that while businesses may come and go, strong and growing clusters provide economic stability to the region [6, 7].

The current state of the economy in the country and in the world as a whole poses the challenge for regions to increase their economic efficiency [8, 9]. A prerequisite for solving

* Corresponding author: iso7773@mail.ru

this problem is the choice of the most competitive model of the regional economy, allowing for maximum use of its potential [10, 11, 12].

Coordination of projects for the socio-economic development of regions, solving problems of increasing the level and quality of life of the regional population can be linked in accordance with the industrial development strategy within the framework of regional investment projects [13, 14].

Industrial development has a stimulating effect on other sectors of the economy (including transport, communications, trade), contributes to the creation of a significant number of jobs, an increase in the tax base and tax revenues at all levels of budgets [15]. According to experts, clustering covers about 65% of the economies of the leading countries of the world [16, 17].

The basis for the effective functioning of both clusters and the modern economy is specialization. Specialization is the most important factor and prerequisite for increasing economic efficiency by reducing costs and improving the quality of goods and services [18, 19]. Firstly, specialization allows you to take advantage of the advantages and characteristics of individuals, enterprises, territories, etc., which are determined byinnate abilities and accumulated skills of people, traditions of using technology, the presence of certain natural resources, accumulated capital andetc. Secondly, thanks to the division of labor, people, enterprises, territories can improve their skills, technologies, production equipment, infrastructure in a certain narrow direction, which increases the effectiveness of the efforts expended [20]. Thirdly, simplification of functions during specialization allows mechanization and automation of the production process [21, 22, 23].

Social division of labor (that is, the division of labor between independent enterprises, industries, regions, countries) underlies the existence of commodity relationships. The deeper the social division of labor, the more opportunities for growth of economic efficiency and competitiveness of the national economy [24, 25].

The main factor restraining the deepening of the social division of labor is highthe level of transaction costs, which are understood as costs (tax and non-tax) conclusion and implementation of transactions between subjects of market relations (between suppliers and buyers of raw materials, equipment, labor, financial resources, finished products, etc.). Accordingly, a necessary condition for deepening social division of labor – ensuring a relatively low level of transaction costs. If the latter are too large, then the development of specialization between enterprises does not occur, as a result of which production efficiency does not increase and competitiveness, deeper processing of raw materials does not occur, production of goods with a higher share of added value does not expand [26, 27].

Analysis allowed us to identify the following factors that increase the level of costs of concluding transactions between firms, and, consequently, hinder the deepening of the social division of labor in the economy of Uzbekistan.

2 Materials and methods

The study used data from the agricultural sector of Uzbekistan. Many years of experience in implementing cluster programs in leading countries of the world testifies to their effectiveness [28, 29]. The development of territorial clusters in Uzbekistan is one of the conditions for increasing the competitiveness of the domestic economy and intensifying the implementation of public-private partnership mechanisms [30, 31].

The main goal of implementing cluster policy is to ensure high rates of economic growth and diversification of the economy by increasing the competitiveness of enterprises [32], suppliers of equipment [33], components [34], specialized production and services [35],

research and educational organizations that form territorial production clusters [36]. In addition, the processes of digital transformation of the state [37] and society [38] have a significant impact on cluster policy [39, 40].

As part of the implementation of this goal, the main objectives of cluster policy are:

Formation of conditions for effective organizational development of clusters, including identification of cluster participants, development of a cluster development strategy that ensures the elimination of bottlenecks and restrictions that reduce the competitiveness of products in the framework of creating added value, as well as ensuring the formation of competitive advantages of cluster participants;

Providing effective support for projects aimed at increasing the competitiveness of cluster participants, through focusing and coordination, taking into account the priorities of cluster development, economic policy measures in the following areas: supporting the development of small and medium-sized businesses; innovation and technology policy; educational policy; investment attraction policies; export development policies; development of transport and energy infrastructure; development of economic sectors.

The cluster method allows you to successfully develop the main and related sectors of the economy, optimize technological and logistics processes, and effectively use raw materials, energy, production and labor resources.

In Uzbekistan, in 2018-2022, 506 clusters were created, which are drivers of economic growth, which made it possible to increase production output in them by 32 times over the past five years, bringing production volumes to 28.7 trillion soums.

This was facilitated by an increase in the volume of investments in the development of clusters by 5.2 times in 2018-2022, as well as an increase in the number of employees by 2.5 times. The share of clusters in the country's total exports of industrial products, which was 5% in 2019, reached 11.4% in 2022.

In order to further accelerate the development of the economy, increase production volumes by expanding inter-industry cooperation and increasing the efficiency of the processing industry, it is planned to create a number of new industry and regional production clusters, including:

-six chemical-technological plants based on large industrial enterprises;

- mechanical engineering, including manufacturers of cars and trucks, buses, and agricultural machinery;

- 41 industrial clusters in the Tashkent region;

- electric vehicle by localizing the production of components and materials for electric vehicles;

- gas chemical within the Shurtan complex, as well as others in all regions of the country.

In order to support domestic producers and consumers of products, appropriate subsidies and preferences have been provided. Up to 2.6 trillion is provided for financing the purchase of agricultural machinery in 2023–2024. soums

Providing effective methodological, information, consulting and educational support for the implementation of cluster policy at the regional and sectoral level.

Limiting factors in the implementation of cluster policy in Uzbekistan include:

- low level of small business development, as well as infrastructural and organizational limitations;

- weak level of trust between the main subjects of economic activity;

- lack of entrepreneurial, market culture and information openness;

- low production standards;

- lack of highly qualified management personnel;

- short-term planning horizon, focused onshort money and high one-time income.

3 Results and discussion

Nowadays, a huge number of clustering algorithms are known; two main types of cluster analysis are most often used: hierarchical and carried out by the k-means method.

In the first case, an automated statistical procedure independently determines the optimal number of clusters and a number of other parameters necessary for cluster analysis. The second type of analysis has significant limitations in practical applicability: it requires determining the exact number of clusters to be identified and the initial values of the centers of each cluster; some other statistics are also required. The first method was chosen for the study. To determine the distance between a pair of clusters, the method with a weighted pairwise average was used.

The Table 1 provides a comprehensive overview of the distribution of agricultural production across various categories of farms and organizations in Uzbekistan over the years 2018 to 2023 Q3. The indicators in the table highlight the percentage share of total agricultural production accounted for by different entities, including all categories of farms, dehkan and subsidiary farms, and organizations engaged in agricultural activities. The information is organized annually, allowing for a longitudinal analysis of the evolving structure of agricultural production.

The total agricultural production is set as the baseline at 100% for all categories of farms in each respective year. This indicator serves as a reference point for assessing the proportional contribution of various entities within the agricultural sector.The indicates the percentage share of total agricultural production contributed by farms, showcasing a consistent increase from 26.0% in 2018 to 31.4% in 2022, followed by a slight decrease to 27.4% in 2023 Q3.

Dekhkan and Subsidiary Farms:This category represents the percentage share of agricultural production attributed to dehkan and subsidiary farms. The data reveals a declining trend from 71.2% in 2018 to 61.7% in 2022, followed by a slight increase to 67.1% in 2023 Q3.

Organizations Engaged in Agricultural Activities:The percentage share of agricultural production from organizations engaged in agricultural activities exhibits a steady increase from 2.8% in 2018 to 6.9% in 2022, with a subsequent decrease to 5.5% in 2023 Q3.

Crop Production:The table provides a breakdown of crop production by farms, dehkan and subsidiary farms, and organizations. Notably, crop production by farms increases from 45.3% in 2018 to 55.3% in 2022 before declining to 49.9% in 2023 Q3.

Table 1. Structure of agricultural production

Indicators	2018	2019	2020	2021	2022	2023Q3
Total-All categories of farms	100.0	100.0	100.0	100.0	100.0	100.0
Total-farms	26.0	27.9	28.2	29.3	31.4	27.4
Total-dekhkan and subsidiary farms	71.2	68.3	67.4	65.5	61.7	67.1
Total-organizations engaged in agricultural activities	2.8	3.8	4.4	5.2	6.9	5.5
Crop production-farms	45.3	49.2	52.0	53.1	55.3	49.9
Crop production-dekhkan and subsidiary farms	52.2	46.8	42.3	40.0	35.7	43.4

Crop production-organizations engaged in agricultural activities	2.5	4.0	5.7	6.9	9.0	6.7
Livestock products-farms	4.6	5.1	4.9	5.3	6.1	6.1
Livestock products-dekhkan and subsidiary farms	92.3	91.2	92.0	91.1	89.3	89.5
Livestock products-organizations engaged in agricultural activities	3.1	3.7	3.1	3.6	4.6	4.4

Livestock Products:The percentage share of livestock products in total agricultural production is provided for farms, dehkan and subsidiary farms, and organizations. The data indicates a gradual increase in the contribution of livestock products from 4.6% in 2018 to 6.1% in 2022, remaining stable at 6.1% in 2023 Q3.

Livestock Products by Dekhkan and Subsidiary Farms:This specific breakdown focuses on the contribution of dehkan and subsidiary farms to livestock product production, revealing a consistently high percentage ranging from 89.3% to 92.3% over the years.

Livestock Products by Organizations Engaged in Agricultural Activities: The table shows the percentage share of livestock product production attributed to organizations engaged in agricultural activities, indicating an increasing trend from 3.1% in 2018 to 9.0% in 2022, followed by a slight decrease to 4.4% in 2023 Q3.

Cotton fiber is widely used in the textile industry.The main suppliers of fiber at exchange trading are Uzpakhtasano at JSC and cotton-textile production clusters.

In 2019, the largest share was supplied by Uzpakhtasanoat JSC (91.6% of the total volume of exhibits), so they exhibited 633 thousand tons, of which 425.4 thousand tons were sold for a total amount of 5741.8 billion .sum.When the clusters offered 57.6 thousand tons in the same year, 37.1 thousand tons were sold for the amount of 521.6 billion soums.Due to the expansion of the organizers of cotton-textile production and, as a result, the creation of new clusters, in 2020 the fiber exposure between the two categories of suppliers became equal. Thus, Uzpakhtasanoat JSC put up 413.2 thousand tons for exchange trading, of which 154.8 thousand tons were sold for a total amount of 2173.7 billion soums. On the part of the clusters in 2020, 335.6 thousand tons were issued andsold - 240.2 thousand tons for a total amount of 3547.4 billion soums.In addition, in order to abolish state regulation of prices for the purchase of cotton raw materials and the widespread introduction of market principles in the cotton industry, the liquidation of the organization Uzpakhtasanoat JSC is planned (PP - No. 4633 dated 03/06/2020). As of today, the territorial organizations “Uzpakhtasanoat” have about 35 thousand tons of cotton residue in total.

The part of the daily cotton supplied by Uzpakhtasanoat JSC that remains unsold is mainly resold daily. This is due to the fact that these varietiesconsidered to be of relatively low quality and demand for them is low. Therefore, there is practically no increase in prices for these goods. Main popular brands of cotton there are 1 grade with medium fiber, 4 types - “good” and “high” class. The share of these varieties of the total volume of products sold is 60.8% (147.3 thousand tonsproducts of this brand).It should be noted that when selling products, the main factor is their starting price (as well as the region and brand of cotton on which it is grown). Starting priceat the auction is determined by the seller based on the futures quote for the next delivery month on the New York Mercantile Exchange.

The daily quoted prices set by buyers at the New York Mercantile Exchange are regularly monitored, and on days when prices are lower, purchasing volume increases

significantly.However, some clusters do not use this norm. They set starting prices lower than the prices set by Uzpakhtasanoat JSC.

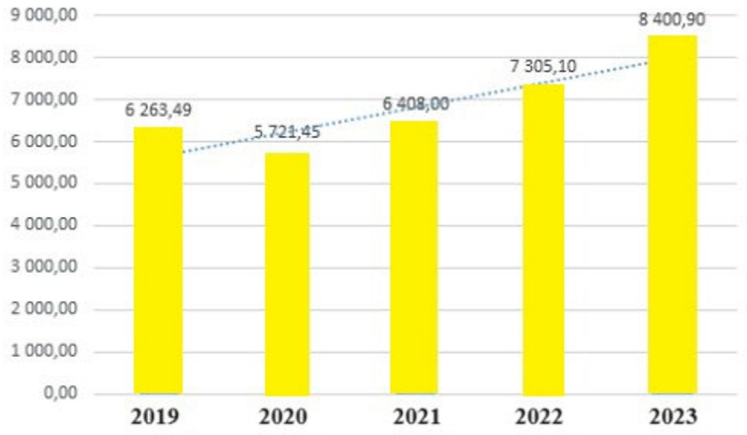

Fig. 1. Agro-clusters results in cotton production (source from: (www.stat.uz)

In general, the initial increase in prices at auction reaches up to 9% (a large increase is observed for highly liquid fiber varieties) (Fig. 1). Due to the increase in prices, sellers received additional income in the amount of 11.6 billion soums (JSC Uzpakhtasanoat - 11.5 billion soums, clusters - 148.2 million soums). In connection with the creation of new clusters and the expansion of production of existing cotton-textile clusters in 2020, the volume of cotton linters offered for exchange trading on their part increased noticeably. Thus, during this period, 95.6 thousand tons of lint were put up for exchange trading, of which 58.3 thousand tons (61%) were sold at an average of 3,131.84 thousand soums per ton (an increase of 3% from the starting price). Including Uzpakhtasanoat JSC exhibited 26.9 thousand tons, of which 17.3 thousand tons (64%) were sold for a total amount of 51.1 billion soums. The market share decreased to 30%. The clusters offered 68.7 thousand tons and sold 41 thousand tons (64%) worth 131.5 billion soums. The market share increased to 70%.

4 Conclusion

Consequently, the use of cluster analysis methods makes it possible to visually group farms by economic indicators, especially when a large number of enterprises and indicators are studied and a general analysis of the state of the industry is needed. It is preferable to carry out clustering using hierarchical cluster analysis, and determine the distance between clusters based on the correlation coefficient.The key findings indicate shifts in the percentage share of total agricultural production among different entities. Farms, as a category, demonstrated a consistent increase from 26.0% in 2018 to 31.4% in 2022, followed by a slight decrease to 27.4% in 2023 Q3. Dehkan and subsidiary farms exhibited a declining trend from 71.2% in 2018 to 61.7% in 2022, with a slight increase to 67.1% in 2023 Q3. Organizations engaged in agricultural activities showed a steady increase from 2.8% in 2018 to 6.9% in 2022, followed by a decrease to 5.5% in 2023 Q3.Further, the breakdown of crop production and livestock products shed light on the dynamics within these categories. Crop production by farms increased from 45.3% in 2018 to 55.3% in 2022 before declining to 49.9% in 2023 Q3. Livestock products demonstrated a gradual increase from 4.6% in 2018 to 6.1% in 2022, remaining stable at 6.1% in 2023 Q3.The research also delves into the cotton industry, highlighting the major suppliers of cotton fiber and their market share. The data reveals the

significant contribution of Uzpakhtasanoat JSC, with a shift in market share towards cotton-textile production clusters in 2020.The conclusion emphasizes the importance of cluster analysis methods for grouping farms by economic indicators, especially when dealing with a large number of enterprises and indicators. Hierarchical cluster analysis, considering the correlation coefficient to determine the distance between clusters, emerges as a preferable method for industry-wide analysis.In summary, the research provides valuable insights into the changing landscape of agricultural production in Uzbekistan, with implications for policymakers, industry stakeholders, and researchers alike. The findings lay the foundation for informed decision-making and strategic planning in the agricultural sector.

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