AMERICAN Journal of Public Diplomacy and International Studies
Volume 4, Issue 5, 2026 ISSN (E): 2993-2157

A Methodology for Evaluating the Efficiency of Inventories in Agro-Industrial Clusters Through Kpis

Toshpo'latov Azizbek Shermuxamadovich

Associate Professor, Department of "Accounting," Tashkent State University of Economics
Candidate of Economic Sciences (PhD)
tshazizbek@gmail.com, ORCID: 0009-0009-0163-7699

Abstract: This article studies the essence and economic characteristics of agro-industrial clusters and the methodological basis of using the KPI (Key Performance Indicator) system in determining their performance indicators. By evaluating the movement of inventories (supply)—one of the main indicators of the production activity of agro-industrial clusters—through the KPI system, it becomes possible to analyze their efficiency and effectiveness and to identify deviations from the planned indicators. On this basis, the performance of the cluster's activity can be assessed and improved.

Keywords: cluster, agro-industrial clusters, inventory, KPI, efficiency, effectiveness.

1. Introduction

Consistent reforms are being carried out in our country to reform the agrarian sector and to introduce market mechanisms, modern management, and technologies into it. As a result, the value created by this sector is growing significantly in the economy. In particular, the introduction of the cluster method of management into the agrarian sector serves as an important factor in the transition to market principles, in sharply reducing state intervention in the sector, and in completely putting an end to plan-chasing and forced labor. As a result, both productivity and income are increasing.

Regarding the management and development of the agrarian sector using the cluster method, the following remarks of President Shavkat Mirziyoyev are of particular importance: "Clusters and interest are the future of Uzbekistan's agriculture. Without introducing science and innovation, this sector cannot be made competitive" [2]. It is also worth recognizing that the introduction of the agro-cluster system into the agricultural sector has produced positive results within a short period.

At present, the issues of intensively developing agriculture, increasing its economic efficiency, further improving the living conditions of rural residents, and ensuring their interest are directly linked to the cluster system—a modern method of agricultural production. As the President emphasized, "the reforms in agriculture and the full transfer of land plots to private clusters and cooperatives made it possible to increase cotton yields by an average of 10 percent in one year" [1]. This requires systematic work to turn the sector into a driver of agriculture in the future by introducing economical and efficient management methods. One such effective method is the KPI (Key

Performance Indicator) system used in agro-clusters, which can be applied as an important tool for making effective management decisions, rationally using available resources, and creating a value chain.

2. Literature Review

The first concepts of KPIs began to take shape in the 1950s through Peter Drucker's idea of "management by objectives" [8]. In his view, in order to achieve results, one must deal separately with efficiency indicators, and managers should focus on indicators that produce results toward priority tasks and the main objective, rather than being occupied solely with day-to-day work.

According to David Parmenter [3], KPIs express "performance indicators" (what should be done in daily work to improve performance), "key result indicators" (what should be done in the future to improve performance), and "key performance indicators" (what should be done to sharply increase performance).

According to M. V. Vishnyakova, "KPIs (Key Performance Indicators) are quantitative indicators of activity—particularly its effectiveness and efficiency—that help to measure the degree of achievement of goals or the optimality of a process" [4]. KPIs are also described as a mechanism that makes it possible to evaluate and control the work of people, groups, the company, and its divisions [7]. In this sense, KPIs constitute a system used to achieve the main goals of any company—attracting and retaining consumers (customers), improving the professional skills of employees, increasing income, and reducing costs—consistent with the principles of total quality management [5], [7].

According to A. D. Askarov, "the main purpose of the KPI system is to evaluate and rank the factors affecting labor motivation by searching for them" [6]. In the broader management literature, KPIs are likewise treated as the measurable core of strategy-driven performance systems [9], [10], [16].

The opinions of the authors cited above are mainly focused on the efficiency and effectiveness indicators by which an enterprise achieves its goals. However, a KPI is an indicator of success in a particular activity or in achieving particular goals—a set of quantitatively measurable indicators of the results actually achieved. In Uzbek, this is often rendered as "key efficiency indicator," which does not fully convey the meaning of "Key Performance Indicators." In our view, efficiency characterizes the relationship between the result achieved and the resources expended, and other indicators can also be measured with the help of KPIs. For this reason, we consider it appropriate to understand a KPI, in the full sense, as a "key activity indicator."

3. Research Methodology

The methodology of the research is based on the general scientific principles that imply comprehensive and systematic approaches to studying economic relations and the phenomena and interconnections in their development, on the basis of data collection, observation, and the study of normative-legal documents. The systematic approach was applied to investigate the concept of agro-industrial clusters, the concept of effective inventory management within them, and the determination of its level of development [11], [14]. In addition, a broad study of foreign experience in applying the KPI system to ensure the efficient use of inventories determined the conduct of research on their effective use [3], [16].

To formalize the supply process and the corresponding indicators, the IDEF0 functional modeling methodology was used [12], [13]. IDEF0 is a functional modeling methodology and a set of graphical notations intended for formalizing and describing business processes; it represents each function through its inputs, outputs, controls, and mechanisms. On this basis, indicators were selected for the logistics-and-supply process of agro-clusters, and the relationships between resources, costs, and results were expressed through a system of KPIs.

4. Analysis and Results

It should be noted that any enterprise requires several years to achieve efficiency in its production and economic activity. To attain production efficiency, the budget projects must first be comprehensible, the introduction of new business processes into practice must be based on sound research, and it must be established that the project will yield benefits for the enterprise over several years (at least three). Today, clearly defining KPIs and introducing them into production is of great importance for enterprises in achieving these results. According to the IDEF0 methodology [12], [13], selecting indicators in relation to the depicted processes is considered the most convenient and effective approach (Fig. 1).

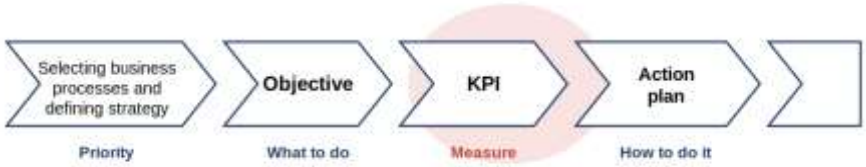

Fig. 1. A method for effectively evaluating indicators based on the IDEF0 methodology

If, as indicated above, the enterprise has defined the reserves used in determining logistics and supply, the resulting inventory items, and the mechanisms for managing them, then this method is an equally effective tool not only for production enterprises but also for public-catering networks. Using the example of agro-clusters, we consider the main types of indicators of the “logistics and supply” process (Fig. 2).

Below, using KPI technology, we examine the development of business projects in the agro-cluster system and divide the processes into several stages to ensure their effective operation, and we define the performance indicators.

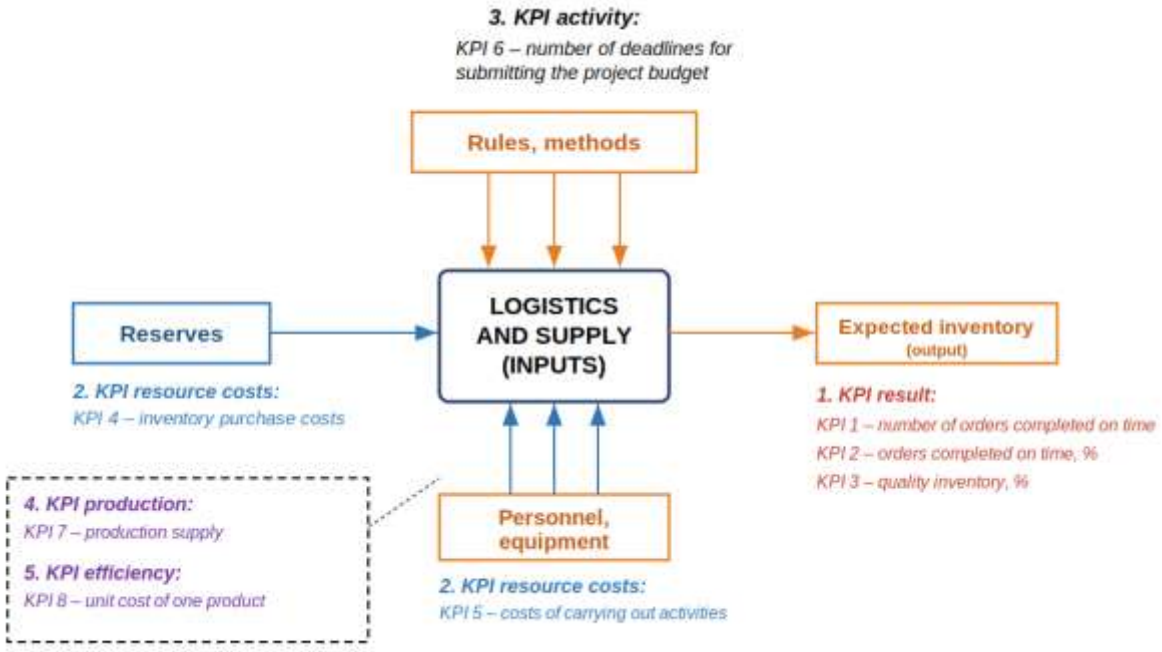

Fig. 2. Algorithm of the logistics-and-supply process of agro-cluster enterprises based on KPI technology

1. Defining the process and its result. For example, the "logistics and supply" process yields the result of "relevant inventory items."

2. Identifying input resources and input mechanisms. Input resources are those consumed in one cycle of the process, while input mechanisms (equipment, personnel) ensure the repeated execution of the process. For instance, the sources of the "logistics and supply" process include: orders placed for inventory items; raw materials and materials to be delivered according to the purchase plan or against received delivery orders; and information on the availability and value of goods and materials in the markets. The mechanisms of the process include the technical support enabling the supply-department staff to organize their work and the qualifications of those staff.

3. Defining process control. This covers the rules and requirements for carrying out the process, for example: instructions (methodologies) for receiving and storing raw materials, semi-finished products, and materials in the warehouse; the methodology for selecting suppliers; the rules for concluding contracts for the delivery of raw materials and materials; and the purchase plan.

4. Forming quantitative indicators while knowing the result to be obtained. These indicators can be computed simply or with the help of formulas and other methods:

KPI 1 – the number of inventory-item orders completed on time;

KPI 2 – orders completed on time, %:

$$\textbf{KPI 2} = (\textbf{KPI 1} / Z) \times 100\ \%,$$

where **Z** is the number of orders placed for the delivery of goods and products;

KPI 3 – the share of goods and materials accepted into production, %:

$$\textbf{KPI 3} = (A / V) \times 100\ \%,$$

where **A** is the quantity of goods and materials supplied to production, and **V** is the total number of goods and materials introduced into production.

5. Forming cost indicators based on the participants of the business process: KPI 4 – the costs of purchasing goods and materials (resource costs).

6. Forming additional cost indicators based on the process mechanisms: KPI 5 – the costs of carrying out the activity (costs for personnel and equipment).

7. Reflecting production indicators in addition to process-correctness and activity-cost indicators: KPI 6 – compliance with the deadlines for submitting the budget project to financial management during the year.

8. Determining, per unit of time, the quality of the results obtained for the production indicators: KPI 7 – the number of orders accepted by the supply department per day, on the basis of production indicators:

$$\textbf{KPI 7} = S / r,$$

where **S** is the volume of orders produced (services rendered) in one month, and **r** is the number of working days in one month.

9. Computing the main production indicators on the basis of the previously defined KPI results and KPI costs. Thus, the efficiency indicator is an integral characteristic of the activity. For example, **KPI 8** serves as the basis for calculating the enterprise's production-efficiency indicator in terms of the unit cost of one order, and is determined by the following formula:

$$\textbf{KPI 8} = \textbf{KPI 5} / \textbf{KPI 1}.$$

In accordance with this principle (the ratio of costs to the obtained result), it is possible to determine production-efficiency indicators as well as project-efficiency or management-efficiency indicators [16]. Naturally, the efficient use of logistics and supply in agro-industrial clusters directly requires research aimed at the efficient use of costs in their management-accounting system and at improving the accounting thereof [14], [15]. The effective application of KPI technology in agro-industrial clusters ensures the efficient functioning of the integrated "supply – production – profit" system.

5. Discussion

The results indicate that the value of the KPI system in agro-clusters lies not in any single indicator but in the way the eight indicators jointly describe the logistics-and-supply process as a connected chain of inputs, controls, mechanisms, results, and costs. This is consistent with the performance-measurement literature, which argues that performance systems should link lagging result indicators with leading process indicators rather than treating them in isolation [9], [10]. In the proposed model, KPI 1–KPI 3 capture results, KPI 4–KPI 5 capture resource costs, and KPI 6–KPI 8 connect activity, production, and efficiency, so that no dimension is evaluated in isolation.

A central feature of the approach is the derivation of composite indicators from primary ones—for example, KPI 8 as the ratio of activity cost (KPI 5) to completed orders (KPI 1). This cost-to-result logic mirrors the general definition of efficiency and allows the same scheme to be reused for production efficiency, project efficiency, or management efficiency [3], [16]. For agro-clusters, where inventories of raw materials and agricultural products are a decisive part of working capital, such ratios make the otherwise implicit trade-off between supply costs and timely, high-quality delivery explicit and measurable [14], [15].

The use of IDEF0 to structure the indicators is also significant from a methodological standpoint. By assigning each KPI to a specific input, control, mechanism, or output of the logistics-and-supply function, the model avoids one of the most common criticisms of KPI systems—namely, that they degenerate into a disconnected checklist of metrics [10]. At the same time, the cluster context [11] implies that these indicators should be coordinated across the members of the value chain rather than optimized by a single enterprise, which is an important condition for the "supply – production – profit" system to function effectively.

Finally, the discussion highlights that the practical value of the system depends on disciplined measurement and feedback. Once an activity is carried out, the actual values of the indicators must be measured and recorded; where actual values deviate significantly from planned ones, the activity must be analyzed and corrective measures developed. In this respect, the KPI system functions simultaneously as an analytical instrument and as a transparent basis for staff motivation [5], [6].

6. Conclusion and Proposals

It can be stated that the practical application of KPIs in the process of moving inventories within agro-cluster activity is an effective tool for ensuring the mutual consistency of financial results and costs, and for identifying and monitoring the effect of planned indicators on quality indicators. After an activity is carried out, the actual values of the indicators are measured and recorded; if there is a serious deviation of the actual values from the planned ones, it becomes necessary to analyze the activity and develop corrective measures.

As a result, among the advantages of using the KPI system in agro-cluster activity, the planning and analysis of entrepreneurial activity are carried out on the basis of the results needed by the business system. Through the systematic analysis of all indicators, the process integrates the activities that will be required in the future. If planning is carried out on its own, separated from real activity, the selection of indicators and their target values nonetheless helps the entity achieve its main goals.

At the same time, as a result of the practical application of KPIs in agro-cluster activity, the motivation system becomes clear and transparent: because planned and actual values are recorded, it becomes evident to the manager why and how an employee should be rewarded, and the employee, in turn, understands well under what conditions and how they will be rewarded or why they will be penalized. Thus, owing to the KPI system, the company rewards the employee for achieving the required results, and the employee is interested in achieving results on an equal footing with the company.

References

[1] Sh. Mirziyoyev, Address of the President of the Republic of Uzbekistan to the Oliy Majlis, Dec. 29, 2020. [Online]. Available: https://president.uz

[2] "Cluster and interest — the future of Uzbekistan's agriculture," Government Portal of the Republic of Uzbekistan. [Online]. Available: https://old.gov.uz

[3] D. Parmenter, Key Performance Indicators: Developing, Implementing and Using Winning KPIs, 4th ed. Hoboken, NJ, USA: Wiley, 2020.

[4] M. V. Vishnyakova, Myths and Truth about KPI. Moscow, Russia: Letopis, 2017.

[5] A. K. Klochkov, KPI and Staff Motivation: A Complete Collection of Practical Tools. Moscow, Russia: Eksmo, 2010.

[6] A. D. Askarov, “International experience in evaluating the activities of faculty members by key performance indicators (KPI),” in Proc. NUU Conf., vol. 3, no. 2, 2022. [Online]. Available: https://nuu.uz

[7] “Key performance indicators,” Wikipedia. [Online]. Available: https://ru.wikipedia.org/wiki

[8] P. F. Drucker, The Practice of Management. New York, NY, USA: Harper & Row, 1954.

[9] R. S. Kaplan and D. P. Norton, “The balanced scorecard—measures that drive performance,” Harvard Business Review, vol. 70, no. 1, pp. 71–79, 1992.

[10] A. Neely, M. Gregory, and K. Platts, “Performance measurement system design: A literature review and research agenda,” International Journal of Operations & Production Management, vol. 15, no. 4, pp. 80–116, 1995.

[11] M. E. Porter, “Clusters and the new economics of competition,” Harvard Business Review, vol. 76, no. 6, pp. 77–90, 1998.

[12] D. Marca and C. McGowan, SADT: Structured Analysis and Design Technique (IDEF0). New York, NY, USA: McGraw-Hill, 1988.

[13] National Institute of Standards and Technology, Integration Definition for Function Modeling (IDEF0), FIPS Pub. 183. Gaithersburg, MD, USA: NIST, 1993.

[14] S. Chopra and P. Meindl, Supply Chain Management: Strategy, Planning, and Operation, 7th ed. Harlow, U.K.: Pearson, 2019.

[15] F. R. Jacobs and R. B. Chase, Operations and Supply Chain Management, 16th ed. New York, NY, USA: McGraw-Hill, 2021.

[16] B. Marr, Key Performance Indicators (KPI): The 75 Measures Every Manager Needs to Know. Harlow, U.K.: Pearson, 2012.