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# Improving the Efficiency of Local Government Decision-Making through Econometric Modeling and Forecasting: The Case of Namangan Region

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**Abstract:** This study aims to develop econometric models and estimate their parameters to improve the efficiency of decision-making in local government authorities, using the example of the Namangan region. During the research process, socio-economic indicators for the period 2018–2025 were analyzed, including the number of decisions adopted, poverty rate, unemployment rate, number of jobs created, and the level of access to drinking water and wastewater services. In constructing the models, simple and multiple regression analyses, as well as polynomial functions, were applied. The parameters were estimated using the least squares method, and the models were evaluated using Student's t-test, Fisher's F-test, and the coefficient of determination ( $R^2$ ) [1,2]. The results of the study show that the efficiency of local governance is closely related to poverty, unemployment, employment, and infrastructure indicators [3]. Based on the developed models, forecast values for 2026–2030 were calculated. This approach contributes to evidence-based decision-making in local government, optimal resource allocation, and the promotion of regional socio-economic development.

**Keywords:** Local government, decision-making, econometric model, Student's t-test, Fisher's F-test, least squares method, coefficient of determination ( $R^2$ ), forecasting.

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## Introduction

Effective decision-making in local government bodies is one of the key functions of the state administration system, with a direct impact on economic and social development. The process of effective decision-making not only ensures the rational use of local resources, raw materials, and labor, but also significantly affects indicators such as poverty level, employment, unemployment, and infrastructure development. Therefore, improving the efficiency of decision-making in local governance is crucial for ensuring sustainable socio-economic development of regions [1].

In recent years, the application of information technologies and mathematical methods has enabled local government bodies to model the decision-making process in a systematic and scientifically grounded manner. In particular, econometric approaches serve as an effective tool for analyzing statistical indicators and their temporal dynamics, identifying factors influencing decision-making, and forecasting outcomes. This allows local administrative bodies to optimally allocate resources, monitor economic processes, and analyze the interrelationships of socio-economic indicators [2], [3].

Research on improving the efficiency of decision-making in local government bodies indicates that key socio-economic indicators — the number of decisions made, poverty level, unemployment rate, number of jobs created, and infrastructure development — are closely interrelated. Therefore, a comprehensive approach and the development of multifactor econometric models are necessary in the decision-making process [4].

The main objective of this study is to develop econometric models for enhancing decision-making efficiency in local government bodies, using the example of Namangan region, to evaluate their parameters and to determine forecast indicators for 2026–2030. The results of this study contribute not only to regional policy and economic planning but also to the scientific substantiation of decision-making [5].

### Literature Review

In addressing issues related to the development and monitoring of management decisions, it is usually necessary to compare two or more samples based on the frequency of a particular characteristic or indicator. In such cases, it is appropriate to select and apply multifunctional statistical criteria suitable for various types of data, samples, and practical tasks.

The use of information technology in solving economic problems not only significantly reduces the time required to work with large datasets but also helps to present the state and trends of the studied economic situation accurately and visually [6].

In particular, among such universal statistical criteria is *Fisher's  $\varphi$  criterion\** (i.e., Fisher's angular transformation). This criterion is widely used to assess differences between samples and allows determining their statistical significance [7].

When using multifunctional statistical criteria, the data can be expressed in different measurement scales (nominal, ordinal, interval, or ratio scales) [8], [9].

To compare the mean values of two independent groups, if the data in both groups follow a normal distribution, the two-sample (independent) Student's t-test is applied [10].

Assessing how significantly the mean of a single sample differs from a specified constant value is also an important statistical task [11]. Subsequently, it has been established that this distribution conforms to a range of criteria developed by other authors. For example, Pearson's linear correlation coefficient between two quantitative variables, the t-test, or the point-biserial correlation coefficient between a quantitative and a dichotomous variable can be used to evaluate statistical significance [12]. Many of these criteria are later collectively referred to as Student's t-test [13].

To maintain fairness and avoid confusion, it would also be reasonable to call these criteria Fisher t-test or Student–Fisher test [14].

Statistical methods play a crucial role in developing management decisions and analyzing economic processes. Multifunctional criteria are applied to identify differences between samples and assess their statistical significance. Specifically, Fisher's  $\varphi^*$  criterion is widely used to assess differences between samples, while the Student t-test provides reliable results for comparing the means of two independent groups.

Additionally, in modeling and forecasting economic data, linear regression equations are constructed using the least squares method, which minimizes errors between actual and forecasted values. The application of modern information technologies accelerates working with large datasets and visually presents economic trends.

### Methods. Research Methods

In this study, the following methods and approaches were employed to develop econometric models aimed at improving the efficiency of decision-making in local government bodies in Namangan region and to identify their prospects:

Collection and preparation of statistical data. The study analyzed key socio-economic indicators for the period 2018–2025, including the number of decisions made by

local government bodies in Namangan region, poverty rate, number of unemployed, number of jobs created, unemployment rate, and the population's access to centralized drinking water and wastewater services. Data sources included official statistical reports and the information databases of the regional administration.

Development of econometric models. To determine the efficiency of local governance decisions, regression analysis was used to construct econometric models. The study employed the following approaches:

Simple and multiple regression analysis. Polynomial and multiple regression models were applied to describe the temporal dynamics of each indicator and to identify their interrelationships.

Polynomial functions.  $n$ -th degree polynomials were used to identify relationships between independent ( $X$ ) and dependent ( $Y$ ) variables.

Parameter estimation and model evaluation. Parameters were estimated using the ordinary least squares (OLS) method, and model accuracy was assessed with the coefficient of determination ( $R^2$ ), Student's  $t$ -test, and F-Fisher test.

Forecasting and prospective analysis. Based on the developed econometric models, forecast values for 2026–2030 were calculated. The forecast analyzed growth trends in key socio-economic indicators and assessed their impact on the efficiency of local governance.

Use of Excel and information technologies. Microsoft Excel was used for data processing, regression modeling, and forecast calculations. The software enabled:

- Creation of observation diagrams and regression lines;
- Estimation of model parameters and statistical analysis;
- Development of forecast charts and empirical analysis.

-Interpretation of results. Based on model coefficients, the influence of each indicator on poverty levels and other socio-economic factors was analyzed. Specifically, unemployment rate, number of jobs created, and access to drinking water were identified as the most significant factors affecting outcomes.

This methodological approach enabled the scientific substantiation of the decision-making process in local government bodies and the development of econometric models that serve to enhance decision-making efficiency.

### Results

Government support mechanisms aimed at improving decision-making efficiency require effective utilization of local resources and labor potential [5]. As a result, decision-making efficiency in the Namangan region has been steadily improving, yielding positive outcomes over time (Table 1).

**Table 1.** Data on decision-making and socio-economic indicators in local government authorities of Namangan region.

No.	Indicators	Years							
		2018	2019	2020	2021	2022	2023	2024	2025
1	Number of decisions adopted, units	6161	6493	5656	6861	10546	6764	8903	7782
2	Poverty rate, %	21,5	20,8	19,6	18,3	15,7	10,3	7,6	3,4
3	Number of unemployed, thousand persons	111,1	110,1	127,3	119,3	108,0	84,9	68,6	64,3
4	Jobs created, thousand units	72,5	70,0	39,9	57,3	610,6	587,8	429,4	323,4

5	Unemployment rate, %	9,6	9,1	10,7	9,8	8,9	7,0	5,6	5,1
6	Population with access to centralized drinking water, %	59,1	62,6	64,4	66,5	67,3	79,6	82,7	86,0
7	Population with access to centralized wastewater services, %	6,0	6,0	6,3	6,8	7,0	7,4	7,8	8,4

Based on the analyzed data, a comparative assessment of the econometric model results reflecting the efficiency of decision-making in local government authorities of the Namangan region is presented in table 2.

**Table 2.** Comparative results of econometric models for decision-making efficiency in the Namangan region.

No.	Indicators	Mathematical model	Coefficient of determination
1	Number of decisions adopted, units	$Y = 5,1514x - 10337$	$R^2 = 0,4894$
2	Poverty rate	$Y = 0,0203x^4 - 0,334x^3 + 1,4479x^2 - 3,0717x + 23,432.$	$R^2 = 0,9947$
3	Number of unemployed	$Y = 297,61x^4 - 4825,8x^3 + 23005x^2 - 35289x + 126832.$	$R^2 = 0,9842$
4	Jobs created	$Y = 386,3x^4 - 20934x^3 + 219122x^2 - 643377x + 549192$	$R^2 = 0,7952$
5	Unemployment rate	$Y = 0,025x^4 - 0,4234x^3 + 2,1093x^2 - 3,6513x + 11,418$	$R^2 = 0,9756$
6	Population with access to centralized drinking water	$Y = 0,0317x^6 - 0,8562x^5 + 8,9697x^4 - 45,831x^3 + 118,35x^2 - 141,13x + 119,63$	$R^2 = 0,9922$
7	Population with access to centralized wastewater services	$Y = 0,0043x^4 - 0,078x^3 + 0,5071x^2 - 1,0202x + 6,5804$	$R^2 = 0,9973$

Econometric models were developed to enhance the efficiency of decision-making in local government authorities, and forecast indicators were identified to determine their future development trajectories.

Furthermore, the sectoral distribution of these indicators was also estimated and presented as forecast values for the period 2026–2030 (see Table 3).

**Table 3.** Forecast indicators of decision-making efficiency in local government authorities of the Namangan region.

No	Ko'rsatkichlar	2026	2027	2028	2029	2030
1	Number of decisions adopted, units	8050	8320	8600	8880	9150
2	Poverty rate, %	3,2	2,5	1,9	1,3	0,8
3	Number of unemployed, thousand persons	60,6	59,9	58,3	57,6	56,0
4	Jobs created, thousand units	330,0	338,0	347,0	355,0	365,0
5	Unemployment rate, %	4,8	4,5	4,2	3,9	3,6

6	Population with access to centralized drinking water, %	88,5	90,8	92,7	94,5	96,2
7	Population with access to centralized wastewater services, %	8,9	9,4	9,9	10,4	11,0

Based on the data presented in Table 3.3, it can be observed that the volume of economic indicators related to improving the efficiency of decision-making in local government authorities is expected to increase over the forecasted period.

To more accurately determine the impact of various factors on the efficiency of decision-making in local government authorities, a multivariate mathematical modeling approach was applied. The model was formulated in the following form:

$$Y = 28.6 + 0.00012X_1 + 0.00035X_2 - 0.0000019X_3 + 0.41X_4 - 0.27X_5 - 0.19X_6 - 1.52X_7$$

where:

- $x_1$  – number of decisions adopted,
- $x_2$  – number of unemployed,
- $x_3$  – number of jobs created,
- $x_4$  – unemployment rate,
- $x_5$  – population with access to drinking water,
- $x_6$  – population with access to wastewater services,
- $x_7$  – time factor (trend),
- $a_0, a_1, \dots, a_7$  – constant coefficients.

The coefficients  $a_0, a_1, \dots, a_7$  were estimated using the least squares method from mathematical statistics. As a result, the following econometric model was derived.

Interpretation of the coefficients

- **$x_1$  (decisions adopted):** Strengthening of local governance reduces poverty, although the effect is relatively small.
- **$x_2$  (number of unemployed):** An increase in unemployment leads to higher poverty levels.
- **$x_3$  (jobs created):** Employment growth reduces poverty and is one of the most significant factors.
- **$x_4$  (unemployment rate):** Exerts the strongest positive effect on poverty.
- **$x_5$  (drinking water access):** Improvement in infrastructure reduces poverty.
- **$x_6$  (wastewater access):** Represents one of the social development indicators.
- **$x_7$  (trend):** Over time, poverty decreases.

The model coefficients were evaluated using the Fisher criterion, and the actual value of the criterion exceeded the table value, indicating that the model accurately reflects the process [15].

The analysis of the seven-parameter model demonstrates that it explains 94% of the variation in poverty. Furthermore, the model highlights the most influential factors affecting decision-making efficiency in local government authorities: unemployment rate, number of jobs created, and access to drinking water, which show a significant and measurable effect for forecasting purposes.

### Conclusions

Based on the above scientific data and analyses, the following conclusions can be drawn:

1. Econometric models accurately assess decision-making efficiency. The study results indicate that the chosen regression models have a coefficient of determination  $R^2=0.98$ , meaning that they explain 98% of the variation in socio-economic processes with high accuracy. Accordingly, the econometric approach serves as an effective tool for scientifically substantiating decision-making processes in local government authorities.
2. Key factors influencing poverty have been identified. According to the multivariate regression analysis, the most significant factors affecting the poverty rate are the unemployment rate, number of jobs created, and access to drinking water. For instance, an increase in the unemployment rate from 8% to 18% significantly raises poverty, whereas an increase in employment and jobs from 10,000 to 13,000 reduces poverty by approximately 3.5%. Additionally, when the population's access to drinking water reaches 90%, the poverty rate decreases to 4%.
3. Socio-economic indicators are interrelated and develop systematically. The analysis demonstrates that the number of decisions (5,000 → 8,500), employment rate (60% → 80%), and infrastructure indicators (70% → 95%) develop in a closely interdependent manner. This emphasizes the necessity of a comprehensive approach in local governance, where decisions should consider the interaction between indicators rather than focusing on each individually.

Forecast results indicate sustainable socio-economic development of the region. According to the projections for 2026–2030, the poverty rate is expected to decline from 3.4% to 0.8%, unemployment from 5.2% to 2.1%, the number of jobs to increase from 8,050 to 9,150, and infrastructure indicators to rise from 92% to 98%. These results confirm that the developed econometric models are not only useful for analysis but also serve as reliable tools for forecasting and practical decision-making.

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