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The use of series and harmonic analysis in the study of the financial and economic performance of food production enterprises

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Abstract: The article examines the seasonality parameters, since the large number of food processing enterprises in our country are dependent on seasonal processes. For this reason, the economic performance of manufacturing enterprises is analyzed based on Fure series and harmonic functions. Based on the results of the analysis, scientific practical recommendations for the development and improvement of the food industry are developed.

Keywords: Food, Industry, Harmonic Analysis, Products, Models, Manufacturing, Enterprises, Economic Indicator, Economy, Consumption, Opportunity, Fure Range.

Introduction

In the Republic of Uzbekistan, the food industry occupies a special place among economic sectors. This industry network covers dozens of industries, including oil and fat, meat and dairy products, fruits and vegetables, canned goods, wine, soft drinks, tobacco products. A number of industries export their products to the near and far abroad. In the food industry, 9.6-10% of gross domestic product is produced in the food industry.

In order to increase the purchasing power of the population in terms of food and daily needs, the domestic consumer market should be regularly and reliably replenished with domestic goods and services. This requires further improvement of the national economy's development mechanism for the production of consumer goods and enterprises [2].

The food market, along with its strategic importance in the national economy, is one of the main conditions that determine the economic independence of the state. It is based on the

intensification of agro-industrial production, on the one hand, and on the other, addressing macroeconomic issues related to the efficiency of social production and increasing the incomes of the population. Therefore, policy development needs to take into account the need and opportunities for policy harmonization [5].

The country has ample opportunities for further development of the food industry and improvement of its territorial structure. While the industry requires a certain number of skilled workforce and manpower, the process is much simpler, and production funds are less demanding. The peculiarity of industrial production is that the product is a direct consumption object, ie a source of human health. Minor deviations in production, interruptions in supply, low profitability or overdue can undermine the product's demand or seriously affect public health. Therefore, the organization of the production process and its proposal in the industry is rather complex.

Analysis and results

There is a wide range of agricultural products that are rich in vitamins and nutrients, depending on the climatic conditions of the regions in Uzbekistan. Currently, most of them are exported to the domestic and foreign markets without semi-finished products. The raw materials of the food industry are to some extent highly processed in some regions (Tashkent, Zarafshan, Fergana). At the same time, while the food industry in some remote regions is growing (especially in Mirzachul and Lower Amudarya), there are still many untapped opportunities. Therefore, development of this sector in the Republic and placement of its regional network are among the most pressing issues.

Economic statistics show that a large number of food companies are dependent on seasonal processes, and their study requires the calculation of seasonality parameters. Therefore, we use harmonic analysis to calculate seasonal parameters. Harmonic methods are based on Fure series and do not override traditional traditional methods, but help develop them and analyze specific variables using objective indicators. One of the advantages of harmonic analysis and information technology in managing the national economy is that it enables enterprises to show the impact of economic performance on the production process and the interaction of resources with the result.

The importance of harmonic analysis can be seen in:

1. Mathematical models based on harmonic analysis serve as a leading tool in the development of economic and natural sciences.

2. The use of material and labor resources is rational when using harmonic analysis.

3. It is possible to make some adjustments during the overall implementation of pronouns using harmonic analyzes and models.

4. Harmonic analysis not only provides an in-depth analysis of economic processes, but also reveals new unexplained patterns of economic processes. It also helps to predict the future economic development.

5. Harmonic analyzes and models allow automation of computational work, facilitation of mental work, scientific organization of labor of economic workers and better preparation of managerial decisions.

Effective modeling of correlation and regression analysis of economic performance data plays a major role in choosing the best possible link between the factors considered.

Periodicity is naturally present in economic, medical, geographic, and biological processes in the environment. In the analysis of time series in the economy, the analysis of harmonic series is used. Use of the following Fure series is crucial in analyzing seasonal processes.

$$f(x)=\bar{x}+\sum_{k=1}^{N}(a_k cos kx+b_k sin kx)$$

Here it is $\bar{x}$ - the average values, a_k,b_k – Fure series coefficients. In the Fure line, the k- value indicates the number of harmonics. The vibrations are expressed in the form of sinusoides and are called harmonics.

In mathematical modeling of seasonal processes by Fure series, mathematical models consist of a set of several sinusoids. For example, if k = 1, Fure array view

$$f(x)=\bar{x}+a_1 cos x+b_1 sin x,$$

$$k=2$$

$$f(x)=\bar{x}+a_1 cos x+b_1 sin x+a_2 cos 2x+b_2 sin 2x,$$

$$k=3$$

$$f(x)=\bar{x}+a_1 cos x+b_1 sin x+a_2 cos 2x+b_2 sin 2x+a_3 cos 3x+b_3 sin 3x$$

Based on the case studies, it is advisable to use three harmonics in the analysis of economic processes at these enterprises [6].

The nonlinear coefficients in these formulas are calculated using the least squares method of mathematical statistics [4].

$$a_0 = \frac{\sum_{k=1}^{N} x_k}{N},\ a_k = \frac{2\sum_{k=1}^{N} x_k \cos kx}{N};\ b_k = \frac{2\sum_{k=1}^{N} x_k \sin kx}{N};$$

Harmony analysis of enterprise performance reveals the potential of the enterprise and its impact on production. This article explores the processes and factors that affect the production of enterprises and their optimization. Take, for example, the enterprise "Uchkurganmandmahsulotlari" Namangan region.

Table-1

N	Years	In action i / ch at prices (billion)	Flour release tons	Mixed tons of feed	Bran tons	Net profit of the enterprise (million)
1	2012	9.81	52.83	12.21	16.19	71.2
2	2013	9.91	56.79	17.86	17.12	78.6
3	2014	11.92	57.26	23.83	17.21	107.0
4	2015	13.91	58.61	25.33	17.80	101.5
5	2016	16.83	58.15	28.22	17.98	103.3
6	2017	26.04	59.01	31.14	18.11	117.5
7	2018	33.38	60.42	32.41	19.02	153 .4

The table is prepared by the author based on the economic performance of the Uchkun Commodities.

We will make the following determinations by analyzing the table $x_1^{(i)}$ - production volume at current prices, $x_2^{(i)}$ - flour production volume, $x_3^{(i)}$ - Compound feed production, $x_4^{(i)}$ - making bran, Y – Let the enterprise be a net profit.

Using the methods of harmonic analysis on the above table, we create general mathematical models based on actual production volumes, flour production, feed production, bran production, and net profit for the enterprise:

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Production at current prices:

$$f(x_1) = 16{,}74 + 2{,}02\sin\frac{\pi x}{6} - 8{,}15\cos\frac{\pi x}{6} - 3{,}47\sin\frac{\pi x}{3} + 4{,}64\cos\frac{\pi x}{3} + 2{,}69\sin\frac{\pi x}{2} - 1{,}63\cos\frac{\pi x}{2} -$$
$$- 1{,}43\sin\frac{2\pi x}{3} + 0{,}19\cos\frac{2\pi x}{3};$$

Flour production:

$$f(x_2) = 55{,}65 - 0{,}42\sin\frac{\pi x}{6} - 5{,}59\cos\frac{\pi x}{6} - 0{,}38\sin\frac{\pi x}{3} + 2{,}69\cos\frac{\pi x}{3} + 0{,}44\sin\frac{\pi x}{2} - 0{,}67\cos\frac{\pi x}{2} -$$
$$- 0{,}12\sin\frac{2\pi x}{3} + 0{,}02\cos\frac{2\pi x}{3};$$

Compound feed production:

$$f(x_3) = 228{,}43 - 70{,}79\sin\frac{\pi x}{6} - 306{,}29\cos\frac{\pi x}{6} + 38{,}8\sin\frac{\pi x}{3} + 154{,}13\cos\frac{\pi x}{3} - 17{,}97\sin\frac{\pi x}{2} - 49{,}82\cos\frac{\pi x}{2} -$$
$$- 1{,}44\sin\frac{2\pi x}{3} + 5{,}66\cos\frac{2\pi x}{3};$$

Making bran:

$$f(x_4) = 15{,}93 + 0{,}6\sin\frac{\pi x}{6} - 6{,}21\cos\frac{\pi x}{6} - 2{,}15\sin\frac{\pi x}{3} + 3{,}81\cos\frac{\pi x}{3} + 0{,}8\sin\frac{\pi x}{2} - 1{,}28\cos\frac{\pi x}{2} -$$
$$- 0{,}98\sin\frac{2\pi x}{3} - 0{,}01\cos\frac{2\pi x}{3};$$

Net Profit:

$$Y = 93{,}65 + 1{,}63\sin\frac{\pi x}{6} - 4{,}37\cos\frac{\pi x}{6} - 2{,}29\sin\frac{\pi x}{3} + 2{,}14\cos\frac{\pi x}{3} + 1{,}46\sin\frac{\pi x}{2} - 0{,}45\cos\frac{\pi x}{2} -$$
$$- 0{,}63\sin\frac{2\pi x}{3} - 0{,}1\cos\frac{2\pi x}{3};$$

The mathematical models analyzed are significant with a probability of 0.95 according to Fisher's statistics.

Conclusion and Recommendations

Economic efficiency can be achieved only if the volume of production exceeds the level of production. Achieving efficiency will be the basis for the country's development, growth of GDP, satisfaction of socio-economic needs of the population, reduction of unemployment rates, improvement of the welfare of the population and improvement of working conditions.

On the basis of mathematical models, economic analysis and conclusions can be made in months and quarters to estimate the actual production volume, flour production, feed production, bran production, and the total production by month and quarter.

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