APPLICATION OF AVERAGE VALUES IN PROBLEMS OF THE TEXTILE INDUSTRY

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Annotation: The article studies the use of arithmetic averages and other averages in issues related to data analysis in the textile industry. Examples of the use of the average indicator of equipment production, the average of raw material consumption, as well as the average value of the duration of operations are given. Practical problems with calculations are presented, and the importance of statistical methods in assessing production processes is shown. The article concludes that the use of mathematical statistics is of great importance in increasing production efficiency and quality control in the textile industry.

Аннотация: В статье исследуется применение средней арифметической и других средних величин в задачах, связанных с анализом данных в текстильной промышленности. Рассматриваются примеры использования средней выработки оборудования, среднего расхода сырья, а также средней продолжительности операций. Приводятся практические задачи с расчетами, демонстрирующие важность статистических методов для оценки производственных процессов. Делается вывод о значимости применения математической статистики для повышения эффективности производства и контроля качества в текстильной отрасли.

Introduction

The modern textile industry requires constant monitoring of production quality, production volume, raw material consumption and energy costs. Mathematical statistical methods are one of the main tools in analyzing these indicators. The most commonly used feature in statistics is the average value, which allows you to describe the typical value in a sample and identify deviations. In the textile industry, average values are used at all stages of the production cycle: from calculating the productivity of machines to assessing the average length of yarn breaks. Their correct application allows you to make informed decisions and improve technological processes.

Basic concepts

The average is the sum of all values divided by their number:

Formula:

$$\bar{x} = (x_1 + x_2 + x_3 + ... + x_n) / n$$

Weighted average - used if the observations have different weights:

$$\bar{x}vz = (w_1 \cdot x_1 + w_2 \cdot x_2 + ... + w_n \cdot x_n) / (w_1 + w_2 + ... + w_n)$$

Other types of averages (geometric, harmonic) are less commonly used, but can be useful in certain situations.

Application in the textile industry

Average values are used for:

Equipment efficiency assessment: In the textile industry, average values are used to assess equipment efficiency, which allows for the analysis of the average speed of machines, average daily output, and capacity utilization ratio. This data helps to compare actual indicators with planned ones, identify inefficient equipment and optimize their loading. For example, calculating the average speed of a weaving machine (total fabric length / operating time) or the average daily output (monthly volume / working days) gives an objective picture of productivity. Analysis of the dynamics of average values allows you to timely identify a decrease in efficiency, plan repairs and justify equipment modernization. Thus, the use of average values helps enterprises ensure stable production volumes, minimize downtime and increase overall profitability.

Raw material volume planning: Average values play an important role in raw material volume planning in the textile industry, since the average consumption of materials (yarns, dyes, auxiliary materials) per unit of product is the amount of raw materials required for a continuous production process. For example, knowing the average consumption of cotton yarn per meter of fabric or the consumption of dye per batch of product allows a company to accurately determine the volume of purchases, avoid downtime due to shortages or excess inventory that increases storage costs. In addition, analyzing the average consumption of raw materials over different periods helps to identify deviations, which can signal problems in production (for example, excessive consumption due to poor quality raw materials or equipment malfunctions) and reduce costsallows for timely corrective measures to optimize and improve production efficiency.

Product quality control: Average values are actively used in product quality control in the textile industry, where production standards are set and deviations are identified based on average values of parameters such as fabric density, yarn strength, dyeing uniformity, and defect frequency. For example, regular calculation of the average value of the fabric's tear resistance allows you to monitor the compliance of the product with technical requirements, and analysis of the average percentage of defects by batch helps to identify problems in the technological process in a timely manner. Comparing current averages with normative values allows you to quickly correct production, eliminate factors that cause quality degradation, which helps to produce consistently high-quality products and reduce consumer complaints.

Analysis of the duration of operations: Average values are used in the analysis of the duration of operations in textile production, where calculating the average execution time of the main processes (spinning, weaving, dyeing, sewing) helps to optimize the production cycle. For example, determining the average operating time of a weaving loom per meter of product or the average time spent on re-adjusting equipment helps to identify bottlenecks in the technological chain. Analyzing the dynamics of these indicators allows for a rational allocation of labor resources, reducing equipment downtime, and improving production capacity planning, which ultimately leads to increased output and reduced costs without compromising quality.

Study of defects and defects: Average values play an important role in the study of defects and defects in textile products, allowing to analyze the average percentage of defective products in a batch, the average number of defects per unit of product and their typical distribution by type (for example, uneven dyeing, weaving defects or thread breaks), which helps to identify systemic problems in production. Comparing the average indicators of defects in different periods allows to monitor the dynamics of quality, to assess the effectiveness of the adopted corrective measures and to identify the most problematic parts of the technological process. Analysis of this data allows to purposefully eliminate the causes of defects, reduce the level of defects and minimize production losses, which ultimately increases the profitability of the enterprise and consumer satisfaction with the quality of the product.

Practical problems:

Example 1. Equipment productivity

Condition: 5 looms produced 90, 105, 95, 100 and 110 meters of fabric per shift.

Solution:

$\bar{x} = (90 + 105 + 95 + 100 + 110) / 5 = 500 / 5 = 100$

Answer: Average output — 100 meters per shift.

Example 2. Cotton consumption

Condition: 350, 370, 340, 360, 380 g of cotton were consumed for five products.

Solution:

$\bar{x} = (350 + 370 + 340 + 360 + 380) / 5 = 1800 / 5 = 360$

Answer: Average consumption — 360 g per product.

Example 3. Average salary taking into account positions

Condition: 3 weavers (130,000 soums each), 1 foreman (200,000 soums).

Solution:

$\bar{x} = (3 \cdot 130{,}000 + 1 \cdot 200{,}000) / (3 + 1) = (390{,}000 + 200{,}000) / 4 = 590{,}000 / /4 = 147{,}500$

Answer: Average salary — 147,500 soums.

Example 4. Average duration of operations

Condition: Operations lasted 12, 15, 14, 13, 16 minutes.

Solution:

$\bar{x} = (12 + 15 + 14 + 13 + 16) / 5 = 70 / 5 = 14$

Answer: The average duration is 14 minutes.

Conclusion

The examples considered show that average values allow you to summarize data, compare performance, identify deviations, and forecast future results. Their use increases the controllability and transparency of the production process.

Conclusion

Mathematical statistics, in particular, the use of average values, is an integral part of modern production management. In the textile industry, where data is collected at all levels, statistics helps to optimize resources, improve product quality, and minimize losses. Average values allow you to make objective decisions based on real indicators.

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