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APPLICATION OF HIGHER MATHEMATICS MODELS TO ASSESS FINANCIAL TRENDS IN DIGITAL ENTREPRENEURSHIP

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Abstract
The article discusses the possibilities of using models of higher mathematics for the analysis and assessment of financial trends in the field of digital entrepreneurship. Particular attention is paid to the use of mathematical analysis, linear algebra, probability theory and elements of economic and mathematical modeling for income forecasting, risk assessment and optimization of management decisions mathematical models. It is shown that the use of methods of higher mathematics can increase the validity of financial decisions and the sustainability of digital business models.

Keywords: Digital entrepreneurship, higher mathematics, financial trends, mathematical modeling, forecasting, data analysis.

Introduction

The development of digital technologies has led to the formation of a new type of entrepreneurship – digital entrepreneurship based on the use of online platforms, big data, automated services and algorithmic solutions. The financial activities of such enterprises are characterized by high dynamism, uncertainty and dependence on many factors.

Under these conditions, traditional descriptive methods of analysis often turn out to be insufficient. The role of higher mathematics models is increasing, which make it possible to formalize economic processes, identify trends, predict financial indicators and assess risks. The purpose of this article is to analyze the main mathematical models used to assess financial trends in digital

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entrepreneurship, as well as to demonstrate their practical use using examples of tasks.

RESEARCH METHODOLOGY

The following methods and approaches were used in the course of the study:

- methods of mathematical analysis (functions, derivatives, integrals);
- linear algebra (matrix models, systems of equations);
- elements of probability theory and mathematical statistics;
- economic and mathematical modeling;
- analytical and comparative analysis.

The methodological basis is the works of domestic and foreign authors in the field of higher mathematics, economics and digital business.

MAIN PART

1. Financial trends in digital entrepreneurship as an object of modeling. Financial trends in digital business include revenue growth, cost changes, demand fluctuations, platform scalability, and the impact of network effects. To analyze them, mathematical functions are used to reflect the dependence of financial indicators on time and other variables.

For example, the revenue of a digital company can be represented as a function:

$R(t) = a \cdot e^{kt}$,

where is the income in time, a is the initial income, k is the growth rate coefficient.$R(t)$

2. The task of income forecasting and its solution.

Task 1. Let's assume that the monthly revenue of a digital startup is described by the

$R(t) = 100 \cdot e^{0,05t}$,

where t is the time in months. It is necessary to determine the rate of income growth at time t = 6.

Solution. The growth rate is determined by the first derivative of the function:

$R'(t) = 100 \cdot 0,05 \cdot e^{0,05t} = 5 \cdot e^{0,05t}$.

Substituting t = 6, we get:

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$R'(6) = 5 \cdot e^{0,05 \cdot 6} = 5 \cdot e^{0,3}$.
Thus, the derivative shows the current growth rate of income, which allows you to assess the financial dynamics of the project.

3. Using linear algebra to analyze financial indicators. In digital entrepreneurship, it is often necessary to analyze several indicators at the same time (revenue, marketing costs, development costs, etc.). It is convenient to represent this in the form of vectors and matrices.
Task 2. Let the cost vector of a digital company look like this:

$$C = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix},$$

where — marketing, — technical support, — development.It is necessary to determine the total costs when changing the cost structure.$c_1 c_2 c_3$
Solution. A change in costs can be described by a matrix of coefficients, and new costs can be described by the product of . This approach allows you to model various scenarios of business development and choose optimal strategies for allocating resources.$AA \cdot C$

4. Risk assessment using probabilistic models. The uncertainty of digital business demand and earnings can be described using random variables. Expected value and variance are used to estimate average returns and risk levels.
For example, if revenue is a random variable, then:X
• $E(X)$ characterizes the expected income;
• $D(X)$– financial risk.
The use of these indicators helps to make more informed investment decisions.

5. Optimizing the profit of a digital service using a derivative
Task 3. The profit of the digital platform depends on the price of the ppp subscription and is described by the function:
$\Pi(p) = -2p^2 + 40p - 120$.
It is necessary to determine the subscription price at which the profit is maximized.
Solution. To find the maximum of the function, use the derivative:

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$\Pi'(p) = -2 \cdot 2p + 40 \cdot 1 - 0 = -4p + 40.$
Let's equate the derivative to zero:
$-4p + 40 = 0$, it follows that $.p = 10$
Second derivative:
$\Pi''(p) = -4 < 0,$
which confirms the presence of a maximum.
Answer: the maximum profit is achieved at the price of the subscription (conventional units).$p = 10$

6. Digital project break-even point model
Task 4. The revenue function of a digital startup is set as:
$R(x) = 15x,$
and the cost function:
$C(x) = 5x + 200,$
where is the number of digital products sold. It is necessary to determine the break-even point.x
Solution. The break-even point is reached when income and costs are equal:
$R(x) = C(x).$
Let's substitute the functions:
$15x = 5x + 200.$
Solving the equation, we get:
From here, we get $10x = 200x = 20$
Answer: A digital project breaks even when 20 units of the product are sold.

7. Integral model of accumulated income
Task 5. The speed of income of the digital service is described by the following function:
$r(t) = 4t,$
where is the time in months. Find the total income for the first 6 months of work.t
Solution. Total income is determined by a certain integral:
$R = \int_0^6 4tdt.$
Let's calculate the integral:

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$R = \int_0^6 4tdt = 4 \cdot \frac{t^2}{2} \Big|_0^6 = 2 \cdot 36 = 72.$

Answer: the total income for 6 months will be 72 conventional units.

8. Probabilistic assessment of financial risk

Task 6. The income of a digital project is a random variable and can take the following values:

- 100 thousand rubles with a probability of 0.3;
- 150 thousand rubles with a probability of 0.5;
- 200 thousand rubles with a probability of 0.2.

Find the mathematical expectation of income.

Solution. Expected value is calculated using the formula:

$M(x) = \sum_i^n x_i \cdot p_i.$

Let's substitute the values:

$M(x) = 100 \cdot 0{,}3 + 150 \cdot 0{,}5 + 200 \cdot 0{,}2.$

$$M(x) = 30 + 75 + 40 = 145$$

Answer: the expected income is 145 thousand rubles.

9. Matrix model of investment distribution

Task 7. Investments of a digital company are divided into three areas: marketing, development and analytics. Investment vector:

$$I = \begin{pmatrix} 50 \\ 70 \\ 30 \end{pmatrix}.$$

The efficiency matrix looks like this:

$$A = \begin{pmatrix} 1{,}1 & 0 & 0 \\ 0 & 1{,}2 & 0 \\ 0 & 0 & 1{,}3 \end{pmatrix}.$$

Determine the adjusted investment vector.

Solution.

The corrected vector is found by multiplying the matrix by the vector:

$I' = A \cdot I$

$$I' = \begin{pmatrix} 1{,}1 & 0 & 0 \\ 0 & 1{,}2 & 0 \\ 0 & 0 & 1{,}3 \end{pmatrix} \cdot \begin{pmatrix} 50 \\ 70 \\ 30 \end{pmatrix} = \begin{pmatrix} 55 \\ 84 \\ 39 \end{pmatrix}.$$

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Answer: taking into account the efficiency, investments will amount to 55, 84 and 39 conventional units, respectively.

Conclusion

Conclusion on additional tasks

The problems considered demonstrate that the methods of higher mathematics allow:

- optimize the profit of digital products;
- to determine break-even points;
- to assess the accumulated income;
- take into account financial risks;
- Model resource allocation.

This confirms the high practical importance of mathematical modeling for the analysis of financial trends in digital entrepreneurship.

The application of higher mathematics models plays a key role in the analysis and evaluation of financial trends in digital entrepreneurship. The use of mathematical analysis, linear algebra and probabilistic models makes it possible to formalize complex economic processes, increase the accuracy of forecasts and reduce the level of financial risks.

In the digital economy, mathematical modeling is becoming an integral tool for management and strategic planning. Further research may focus on the use of more sophisticated models, including optimization and machine learning techniques.

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